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SUMMARY OF RESULTS FOR A TWIN-ENGINE, LOW-WING AIRPLANE SUBSTRU--ETC(U)
JAN 79 G WITTLIN DOT-FA75WA-3707
UNCLASSIFIED LR-28869 FAA-RD-79-13 NL

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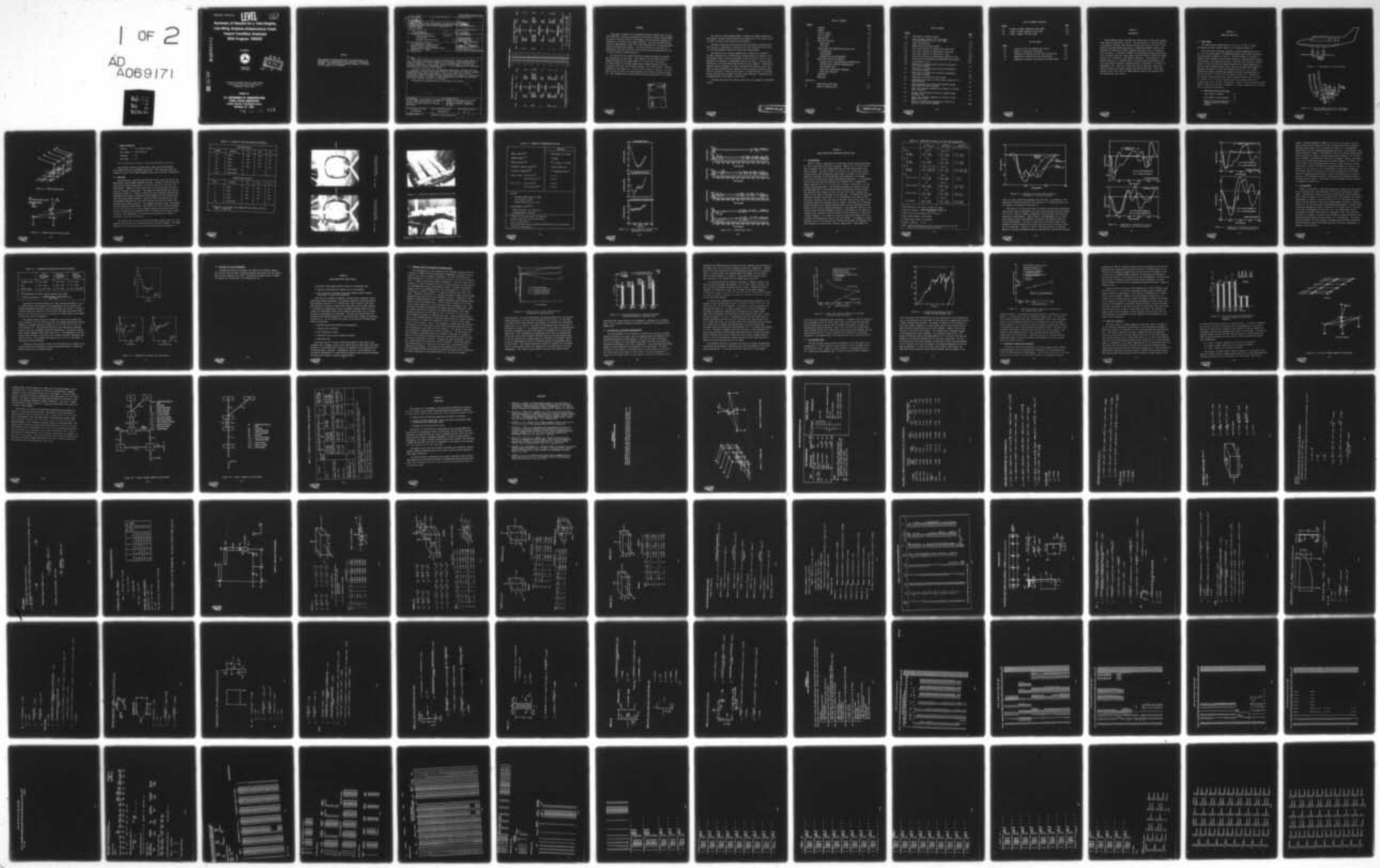

REPORT NO: FAA-RD-79-13

LEVEL

Summary of Results for a Twin-Engine, Low-Wing Airplane Substructure Crash Impact Condition Analyzed With Program 'KRASH'

Gil Wittlin

January 1979
Final Report

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16. Abstract

This report contains the results of using digital computer program KRASH to model and analyze the dynamic response of a twin-engine, low-wing airplane substructure subjected to a 27.5 ft/sec vertical velocity impact. The test was performed previously by NASA-Langley as part of a joint FAA-NASA effort concerning general aviation airplane crash dynamics.

Included in this report are the math model description, pertinent test data, a comparison of analysis versus test results and the results of a limited parameter sensitivity study using program KRASH. Floor and occupant pelvis vertical acceleration responses obtained from test measurement are compared to corresponding analytical results. The effect of model representation and input data selection variations on dynamic behavior are evaluated.

Conclusions are presented based on the results of the effort.

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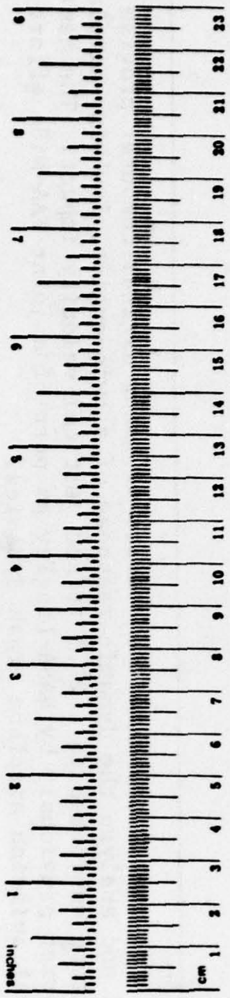
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

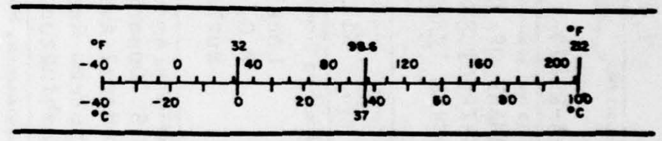
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



FOREWORD

This report, prepared by the Lockheed-California Company under Contract DOT-FA75WA-3707, contains a description of the effort in which program KRASH was used to model and analyze a twin-engine, low-wing airplane substructure subjected to a vertical crash impact condition. The test was performed previously by NASA-Langley as part of a joint FAA-NASA effort concerning general aviation airplane crash dynamics. The work discussed in this report was administered under the direction of the Federal Aviation Administration with H. Spicer acting as Technical Monitor.

Gil Wittlin of the Lockheed-California Company performed the analysis and correlation with test data. Bill LaBarge of the Lockheed-California Company assisted in the initial phases of the math model development. Dr. Robert Hayduk of the NASA-Langley Impact Dynamics Research Facility coordinated the effort and provided structure, test and film data. The data presented in this report are a partial input to NASA for purposes of evaluating the state of the art in light-airplane crash dynamics modeling and analysis. The Lockheed effort was performed under the supervision of J.E. Wignot.

SUMMARY

The results of using program KRASH to analyze the dynamic response of a twin-engine, low-wing airplane substructure subjected to a 27.5 ft/sec vertical impact velocity crash condition are presented.

Included in this report are the math model description, pertinent data from the test, a comparison of analysis versus test results and the results of a limited parameter sensitivity study using program KRASH.

The substructure is modeled symmetrically in KRASH with 32 masses, 57 member elements and 44 nonlinear beam element degrees of freedom. Floor and occupant pelvis vertical acceleration responses obtained from test measurements are compared to corresponding analytical results. Occupant chest, substructure roof, and window-ledge motions are also compared. Variations in external spring (crushable structure) load-deflection behavior, seat stiffness, occupant representation, analytical filter frequency cutoff and model size are included to ascertain their effect on dynamic behavior for the particular substructure and impact condition being evaluated. Conclusions are presented based on the results of the effort.

Pertinent math model and computer output data are presented in Appendices A and B.

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SECTION 1

INTRODUCTION

Program KRASH has been validated with several sets of full-scale aircraft crash test data (References 1 and 2). The availability of crash test data for a twin-engine, low-wing, light-airplane substructure and an additional impact condition provided another opportunity to demonstrate KRASH's capability to represent the significant dynamic response characteristics of a survivable crash condition. In addition to KRASH, the twin-engine airplane substructure is to be modeled using two other digital computer programs, DYCAST and ACTION, designed for a structural crash dynamics evaluation. The modeling of a particular structure for a defined impact condition using three different current crash dynamics computer programs provides an opportunity to compare the requirements for: model size, input data, ease of modeling, output data, analysis versus test results, machine costs and machine time. This report concerns itself solely with the KRASH modeling results and comparison with the substructure test results.

SECTION 2

MODEL AND TEST DATA

2.1 KRASH MODEL

The substructure representing F.S. 135 to F.S. 181 for a typical twin-engine low-wing airplane (Figure 2-1) is shown in Figure 2-2.

The substructure including occupants is modeled symmetrically (about B.L. 0.0) in program KRASH. The KRASH substructure and occupant representations are shown in Figures 2-3 and 2-4. The floor masses at locations 2 through 6 and 8 through 12 have external springs to represent ground contact and crushing of the underside structure. Only half the structure is shown in Figure 2-3 since the model and impact conditions are treated symmetrically. The dash lines jutting laterally from 14 and 18 are tension-only members to represent the lateral tie rods (see Figures 2-5 and 2-6). For clarity, tension-only members representing occupant seat belts connecting mass 5 to mass 30 and mass 11 to mass 30 are not shown in Figure 2-4. Compression-only members representing the seat cushion and pan connect mass 30 to mass 29. Masses 29, 30, 31 and 32 represent the seat, occupant lower torso, occupant upper torso, and DRI, respectively. Details of the modeling including sample calculations are shown in Appendix A. Computer program input and output data are provided in Appendix B.

- KRASH Substructure model size:

Total number of masses	-	32
Total number of beam elements	-	57
Number of nonlinear degrees of freedom associated with beam elements	-	44

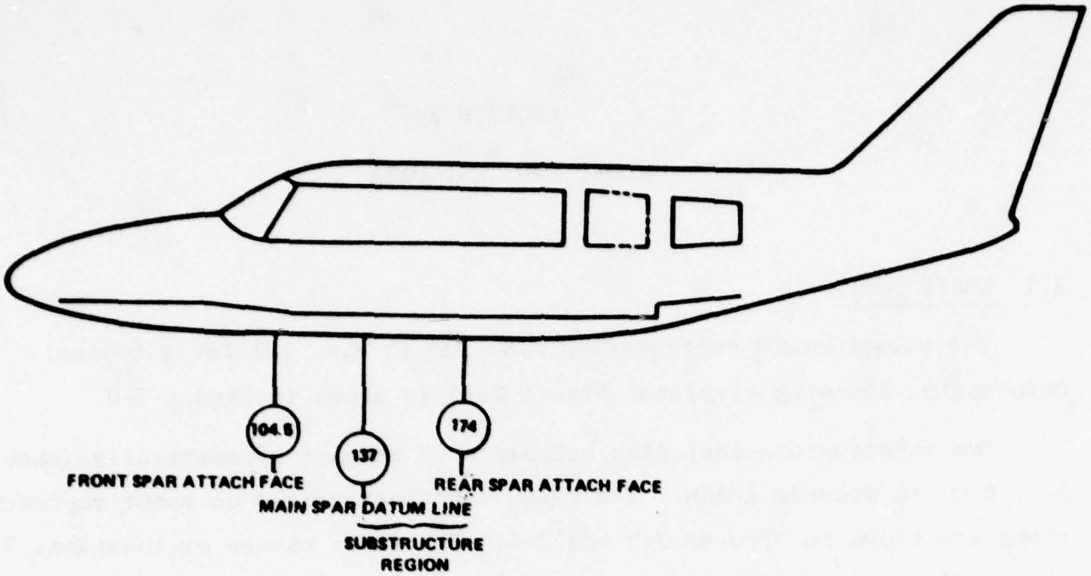

Figure 2-1. - Twin-engine, low-wing airplane.

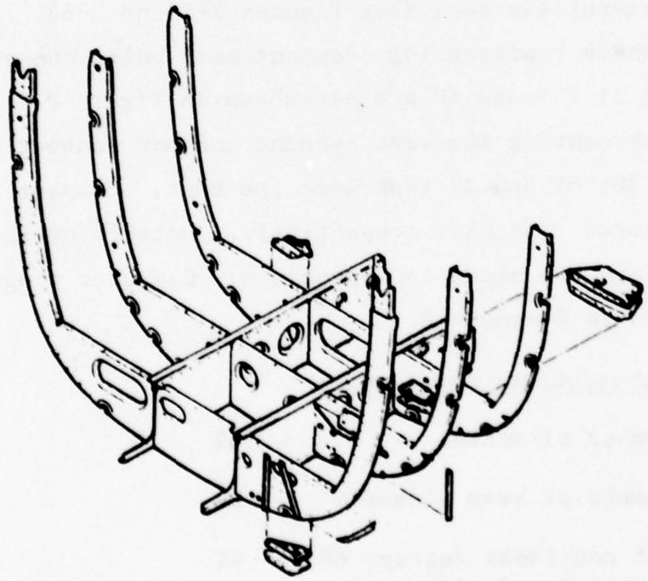

Figure 2-2. - Lower fuselage structure for twin-engine, low-wing airplane (F.S. 135 - F.S. 181).

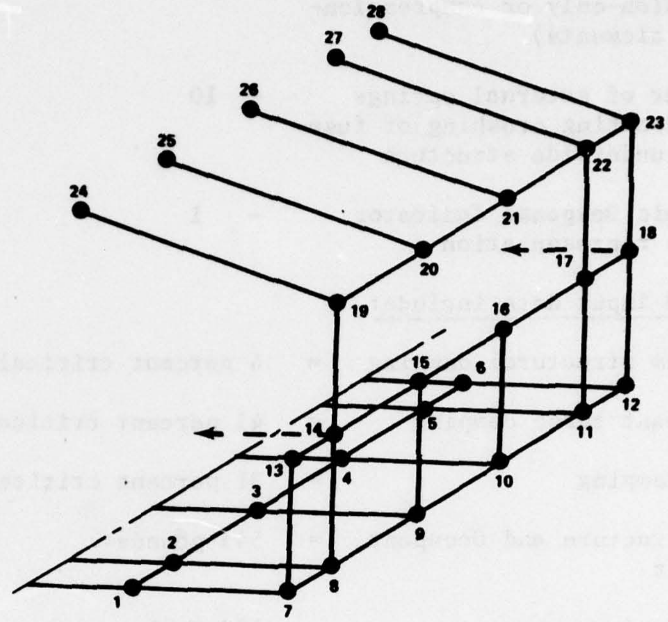

Figure 2-3. - KRASH fuselage model.

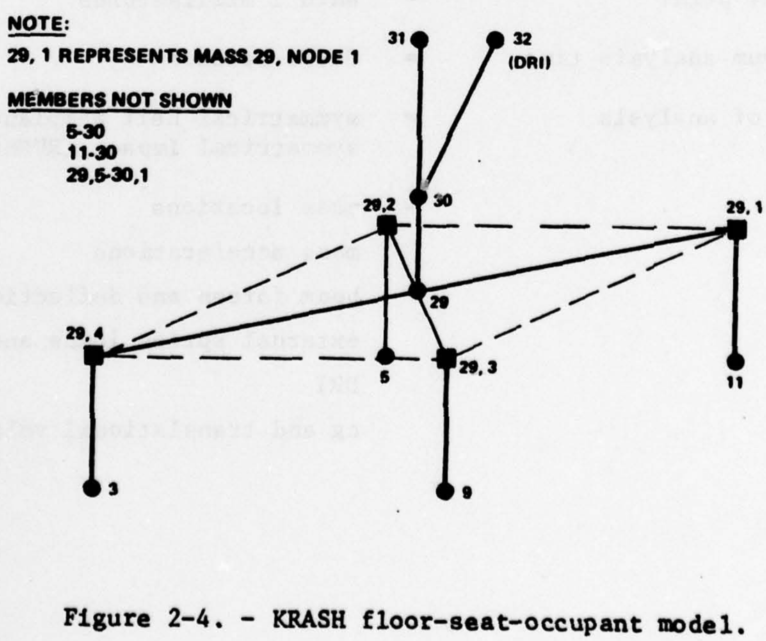

Figure 2-4. - KRASH floor-seat-occupant model.

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• Impact conditions

Velocity	=	27.5 ft/sec vertical
Pitch angle	=	$3/4^{o}$ pitch-up
Yaw-angle	=	0^{o}
Roll angle	=	0^{o}

Table 2-1 shows the location of the test and analysis data points.

The nonlinear deflection values used as input into the KRASH model were obtained directly from KRASH calculations. The deflection values are contained as part of the 'Model Parameter Data' print, provided in Appendix B.

2.2 TEST DATA

The substructure crash test data and film analyses were provided by the NASA-Langley Impact Dynamics Research Facility. Figures 2-5 and 2-6 show the front and rear views, respectively, of the post-crash test condition of the substructure. Figures 2-7 and 2-8 show the floor structure and a portion of the roof structure, respectively. The summary of NASA-provided test data is presented in Table 2-2. Figure 2-9 shows the motion histories obtained from high-speed film analysis, performed by NASA-Langley, for the occupant chest, roof, and window-ledge locations. Figure 2-10 shows the reduced test data accelerometer histories for four floor locations and the two occupant (left and right side) pelvis locations. The channels record D.C. data. The reduced data are obtained by NASA using a least-square fit (LSF) filtering technique. All the test data are for vertical response channels and motions since this direction represents the predominant mode of response for this type of impact condition. Correspondingly, all correlation with analysis is limited to responses in the vertical direction.

The substructure test was previously performed by NASA as part of a joint general aviation crash test program initiated by the FAA and NASA. The impact dynamics test facility and test procedures are described in Reference 3.

TABLE 2-1. - LOCATION OF TEST AND ANALYSIS DATA POINTS

Test Data Points				
Channel	Location	F.S.	W.L.	B.L.
A1	Floor	140.	-16.	6L
A2	Floor	151.	-16.	24L
B2	Floor	151.	-16.	6L
D1	Floor	162.	-16.	24L
D9	Left Pelvic	-	-	-
D10	Right Pelvic	-	-	-
Analysis Data Points [(a)]				
Mass	Location	F.S.	W.L.	B.L.
2	Floor	140.	-16.	6L
3	Floor	151.	-16.	6L
9	Floor	151.	-16.	20L
10	Floor	163.	-16.	20L
30	Lower Torso	-	-	-

(a) Analysis is performed with symmetrical half model, thus left side = right side.

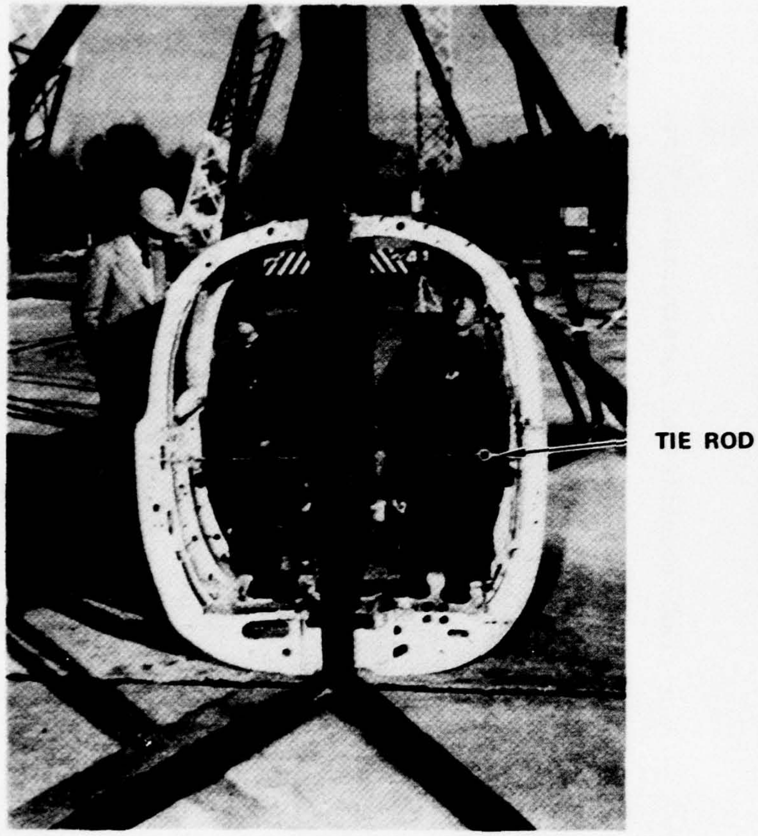


Figure 2-5. - Post-crash condition of substructure, front view

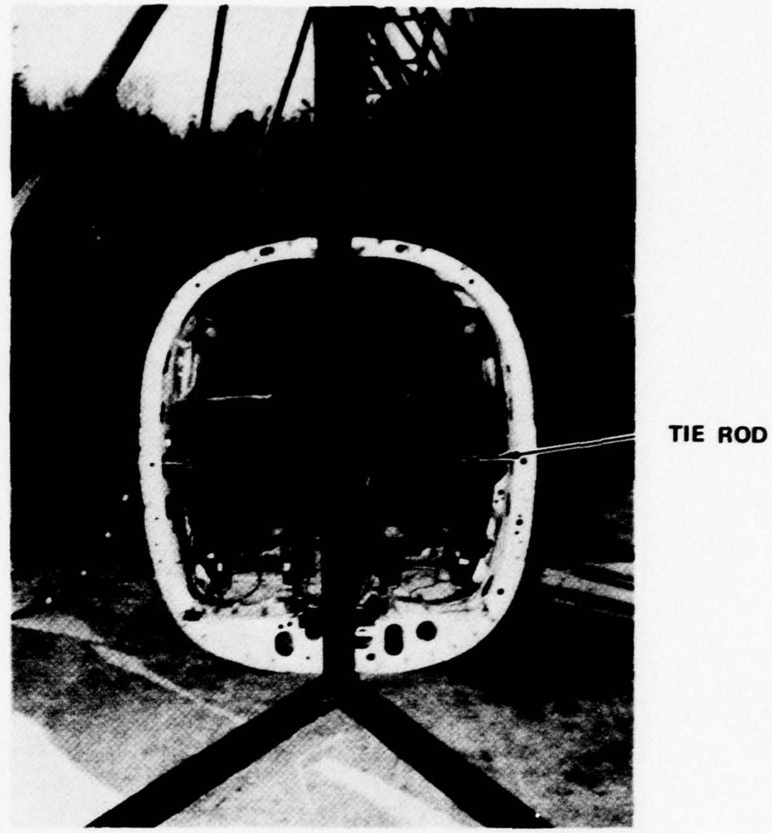


Figure 2-6. - Post-crash condition of substructure, rear view

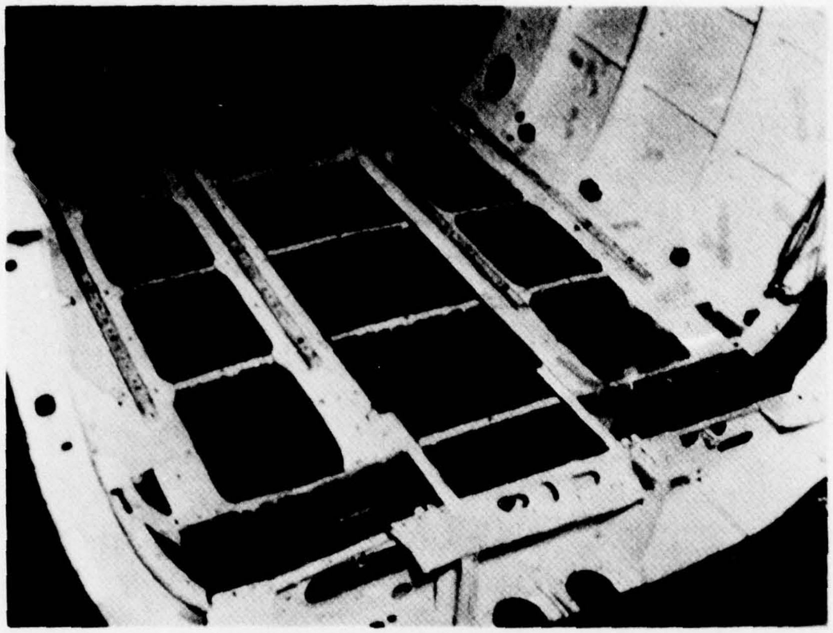


Figure 2-7. - Post-crash condition of substructure, floor

Figure 2-8. - Post-crash condition of substructure, partial of roof

TABLE 2-2. - SUMMARY OF SUBSTRUCTURE TEST DATA

		Magnitude
Impact velocity[a]		330 in/sec; 27.5 ft/sec
Rebound height [a]		5 inches
Rebound velocity[a]		62.1 in/sec; 5.2 ft/sec
Duration of ground contact[a]		0.058 ± 0.0015 sec.
Attitude at impact[a][d]		0.75 degrees pitch-up
Window ledge:	peak motion[a]	1.64 in.
	final deflection[e]	0.65 in.
Roof center:	peak motion[a]	3.65 in.
	final deflection[e]	0.99 in.

Plots[a]

- Occupant chest motion vs. time
- Roof motion vs. time
- Window-ledge motion vs. time

Accelerometer traces[b][c]

Floor structure - A1, A2, B2, D1

Occupant pelvis - D9, D10

[a]Obtained from high speed film analysis
[b]Least Square Fit (LSF) filtered data
[c]D.C. Accelerometers
[d]No significant roll or yaw motion obtained from the film analysis
[e]Post-test measurement

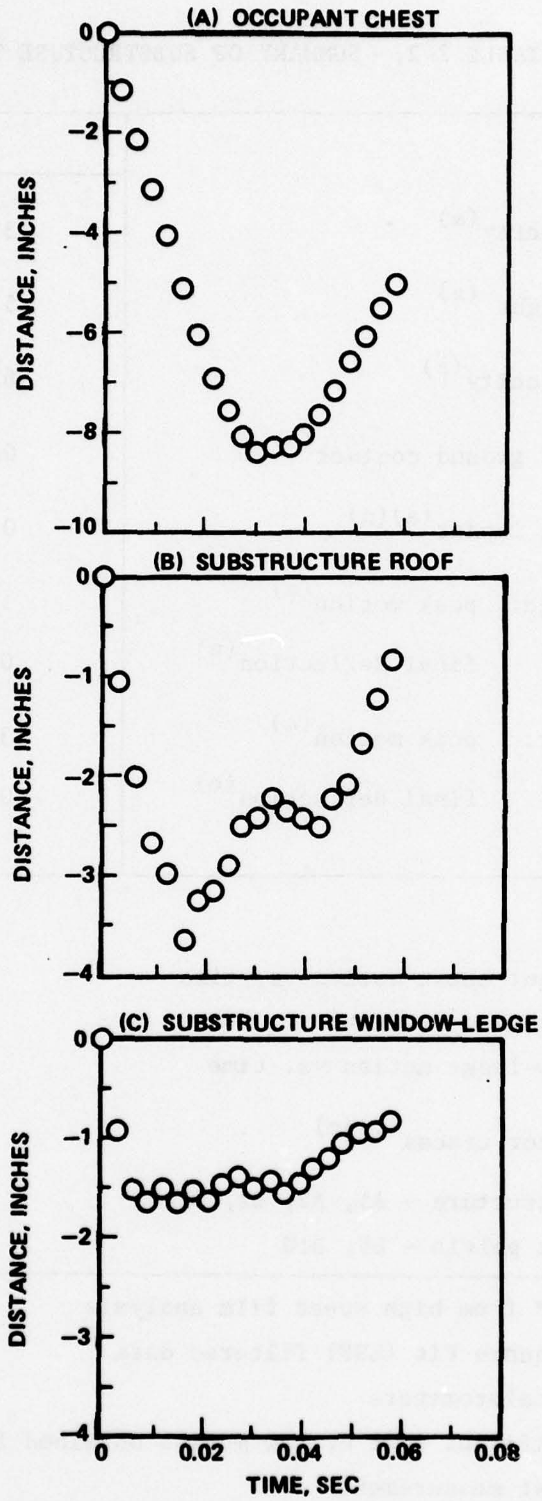


Figure 2-9. - Motion histories obtained from high-speed film analysis

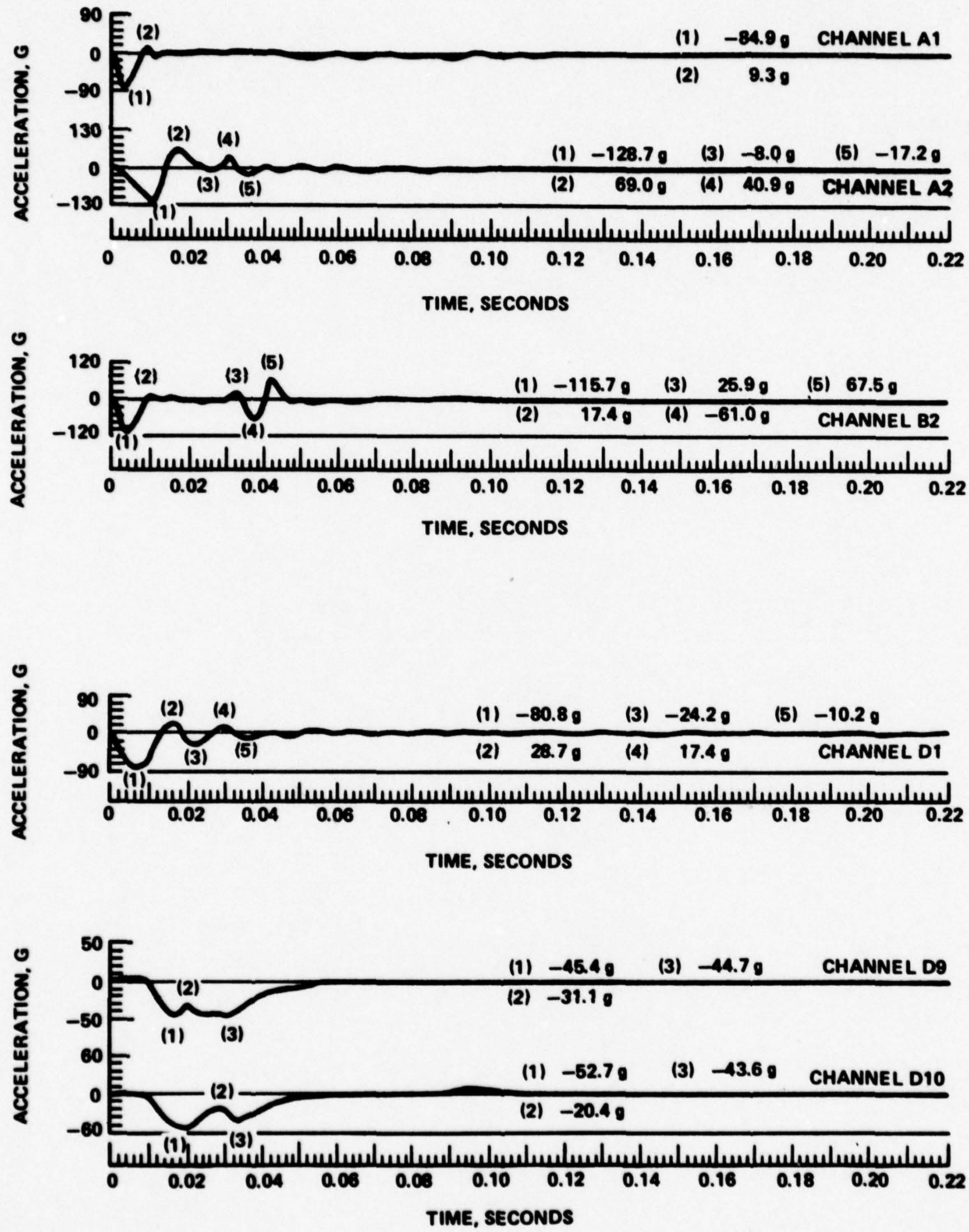


Figure 2-10. - Accelerometer traces

SECTION 3

KRASH RESULTS AND COMPARISON WITH TEST DATA

3.1 ACCELERATIONS

Table 3-1 shows a comparison of the analysis and test peak accelerations for the occupant pelvis and floor responses. Figures 3-1, 3-2 and 3-3 present the analysis and test response histories for the occupant pelvis and floor locations. The data in Table 3-1 show that the analytically obtained occupant pelvis peak accelerations agree within 19 percent for the initial peak and 6.8 percent for the second peak, when compared to the average of the left and right side occupant test measured responses. It is noteworthy that the left and right side measured test responses for a "symmetrical" impact condition differ by 16 percent and 2.5 percent, respectively, for the primary and secondary peaks. The difference between test results is nearly the same magnitude as the difference between the analysis and test results. The analytical data (Figure 3-1) show the same "camel hump" response phenomenon as that which is exhibited in the test data. In addition the two peaks obtained by analysis occur within 4 to 6 milliseconds of the time at which they occur during the test. The test and analysis results show a decay to zero acceleration after the secondary peak is reached. The decay rate is approximately the same for the analysis and test data, with the analytical data preceding the test data by several milliseconds. The analytical results for the occupant pelvis response presented in Table 3-1 and Figure 3-1 are based on a low-pass filter frequency cutoff of 100 Hz as noted in Section 2. The use of a higher frequency cutoff value will result in analytical results which will be higher and consequently closer to the test results. For example, a 150 Hz frequency cutoff in the analysis will increase the primary and secondary occupant response by 5 percent and 2 percent, respectively. This change will

TABLE 3-1. COMPARISON OF ANALYSIS AND TEST PEAK ACCELERATIONS

	Test Accel (Time)[a]	Analysis Accel (Time)[a]	Percent[b] Differences (Time)
Pelvis	(D9)[d]	(Mass 30)[e]	
1st Peak	-45.4 (.018)	-39.7 (.017)	-12.6 (.001)
2nd Peak	-44.7 (.030)	-41.1 (.026)	- 8.1 (.004)
Pelvis	(D10)	(Mass 30)	
1st Peak	-52.7 (.020)	-39.7 (.017)	-24.7 (.003)
2nd Peak	-43.6 (.032)	-41.1 (.026)	- 5.7 (.006)
Pelvis	(Avg. of D9 & D10)	(Mass 30)	
1st Peak	-49.0 (.018-.020)	-39.7 (.017)	-19.0 (.001-.003)
2nd Peak	-44.1 (.030-.032)	-41.1 (.026)	- 6.8 (.004-.006)
Floor	(A1)	(Mass 2)	
Forward Inboard	-84.9 (.004) 9.3 (.010)	-89.0 (.004) 43.9 (.028)	4.8 (0) (c)
	(A2)	(Mass 9)	
Forward Outboard	-128.7 (.010) 69.0 (.018)	-101.0 (.011) 61.8 (.025)	-21.5 (.001) -10.4 (.007)
	(B2)	(Mass 3)	
Forward Inboard	-115.7 (.004) 25.9 (.032)	-90.7 (.004) 34.9 (.026)	-21.6 (0) 34.0 (.006)
	(D1)	(Mass 10)	
Aft Outboard	-80.8 (.008) 28.7 (.017)	-99.2 (.007) 37.1 (.018)[f]	22.8 (.001) 29.3 (.002)

a) Accelerations in G's, time in seconds after impact

b) Percent difference $= \left(\frac{\text{analysis value-test value}}{\text{test value}}\right) \text{X } 100$

c) Test trace shows no response after .012 seconds

d) Test channel numbers in parenthesis

e) Analysis mass numbers in parenthesis

f) Peak at .026 msec = 53.7 g

NOTE: Difference between test results for right (D10) versus left (D9) side ≈16.1% (1st peak) and 2.5% (2nd peak).

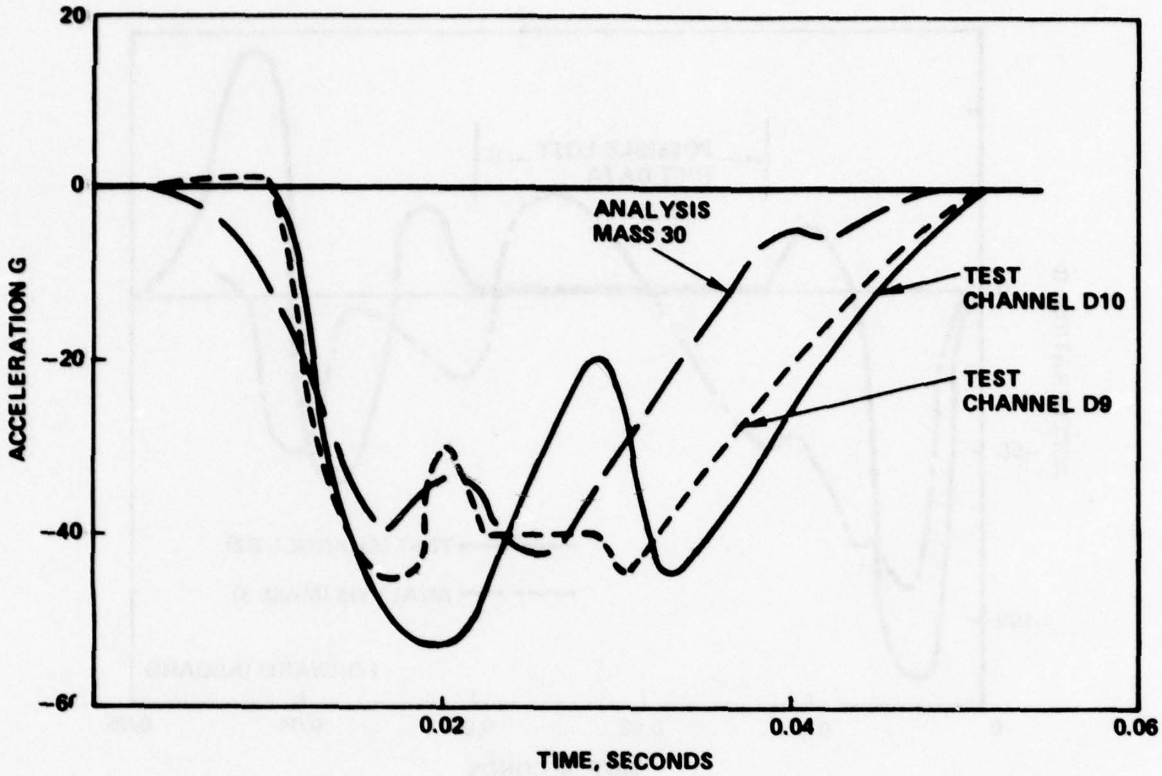


Figure 3-1. - Comparison of occupant pelvis vertical acceleration, test versus analysis.

result in closer correlation agreement with test data. A discussion of the sensitivity of analysis results to the selection of an analytical filter cut-off frequency is discussed in Section 4.4.

From Table 3-1 it can be seen that the analysis initial peak acceleration values agree within approximately ±22 percent with measured test data obtained from the four floor dc channel accelerometer locations which were chosen for comparison by NASA-Langley. NASA considers dc accelerometers to be overall more reliable than ac accelerometers, particularly the behavior after the initial peak response. The time of occurrence of the initial peak values obtained by analysis agrees with the test data peak value occurrences within one (1) millisecond. Figures 3-2 and 3-3 show the similarity in response shapes for the test and analysis results, particularly in the initial response

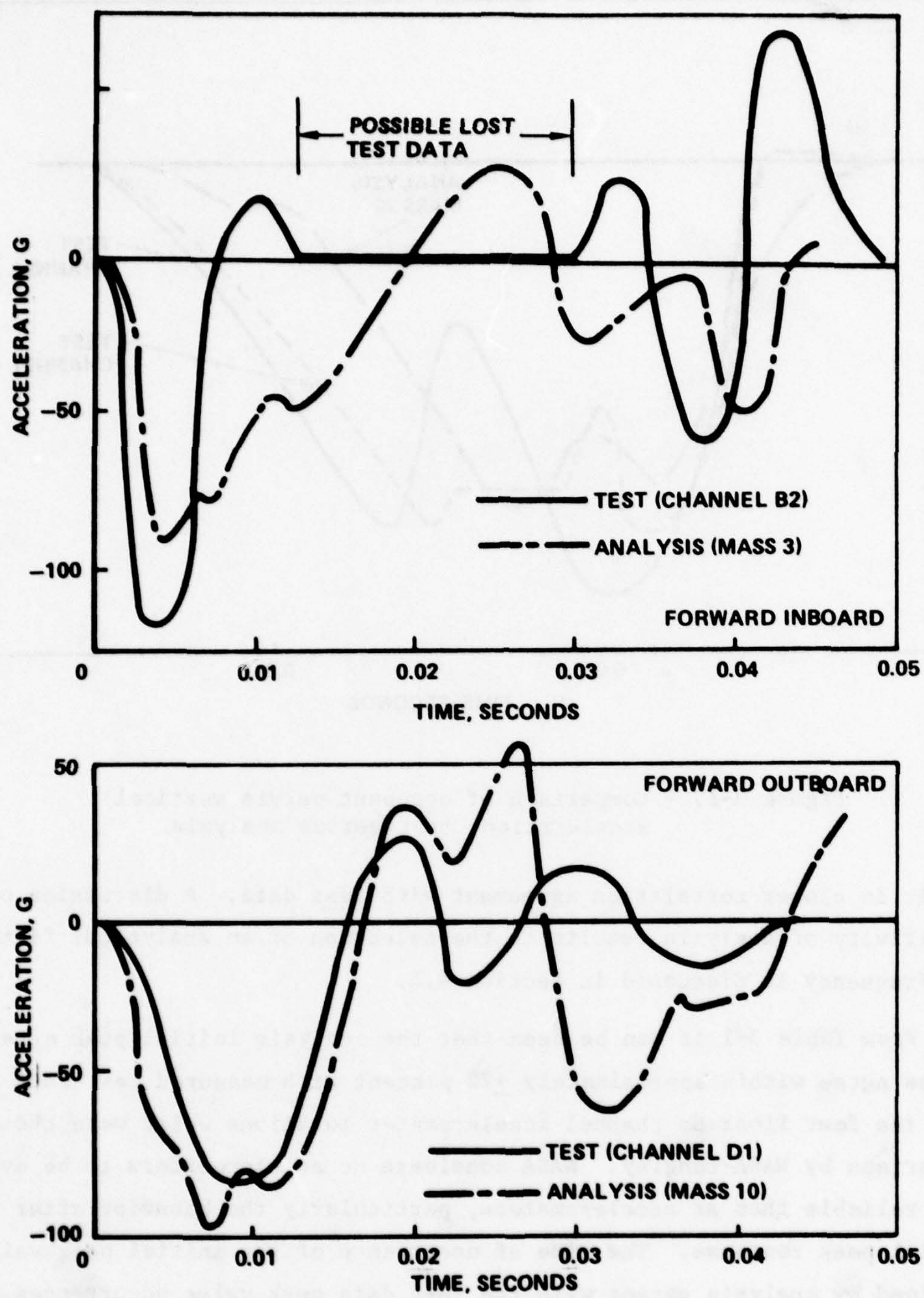


Figure 3-2. - Comparison of fuselage floor vertical acceleration, test versus analysis.

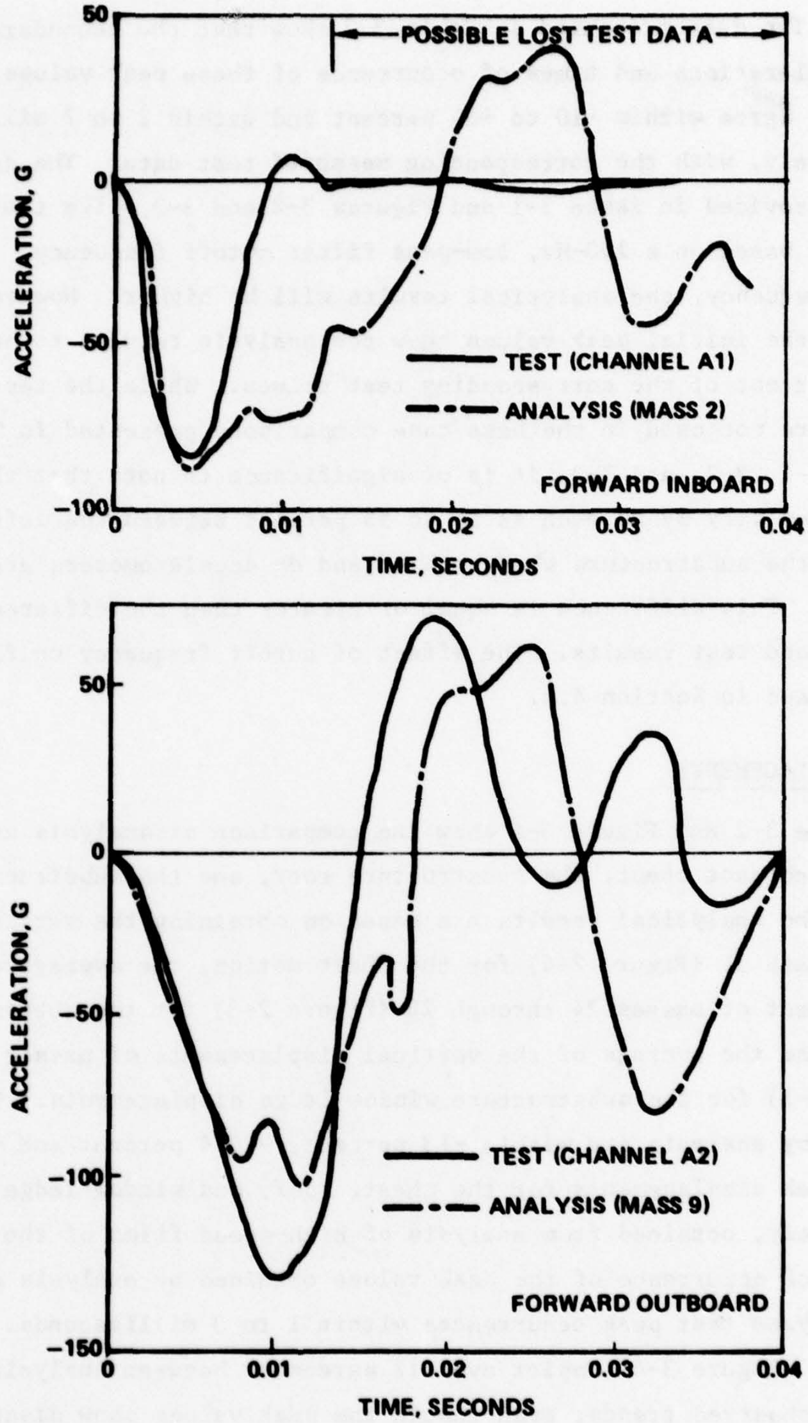


Figure 3-3. - Comparison of fuselage floor vertical acceleration, test versus analysis

regime. The data presented in Table 3-2 show that the secondary (rebound) peak accelerations and times of occurrence of these peak values, obtained by analysis, agree within -10 to +34 percent and within 2 to 7 milliseconds, respectively, with the corresponding measured test data. The analytical floor results provided in Table 3-1 and Figures 3-2 and 3-3, like the occupant pelvis data, are based on a 100-Hz, low-pass filter cutoff frequency. For a 150-Hz cutoff frequency, the analytical results will be higher. However, the comparisons for the initial peak values show the analysis results to be within -11.7 to +34 percent of the corresponding test values. While the test ac accelerometers are not used in the base case comparisons presented in Table 3-1 and Figures 3-1, 3-2, and 3-3, it is of significance to note that the measured test values vary by as much as 16 to 55 percent between the left and right sides of the substructure when both ac and dc accelerometers are included in the data. This difference is equal or greater than the difference between analysis and test results. The effect of cutoff frequency on floor responses is discussed in Section 4.4.

3.2 DISPLACEMENTS

Table 3-2 and Figure 3-4 show the comparison of analysis and test motions for the occupant chest, the substructure roof, and the substructure window-ledge. The analytical results are based on obtaining the vertical displacement of mass 31 (Figure 2-4) for the chest motion, the average of the vertical displacement of masses 24 through 28 (Figure 2-3) for the substructure roof motion, and the average of the vertical displacements of masses 14 through 17 (Figure 2-3) for the substructure window-ledge displacements. The peak values obtained by analysis are within -13 percent, -27.4 percent and +43.3 percent of the peak displacements for the chest, roof, and window-ledge motions, respectively, obtained from analysis of high-speed films of the crash test. The time of occurrence of the peak values obtained by analysis agree with the film-analyzed test peak occurrences within 1 to 3 milliseconds. The motion histories (Figure 3-4) depict overall agreement between analysis determined and test-observed trends, even though the peak values show disagreements of between 13 and 43 percent.

TABLE 3-2. - COMPARISON OF ANALYSIS AND TEST PEAK MOTIONS

	Test Displacement (time)[a]	Analysis Displacement (time)[a]	Percent Difference (time)[b]
Occupant Chest	8.40 (.030)	7.30 (.033)	-13.1 (.003)
Roof	3.65 (.015)	2.65 (.013)	-27.4 (.002)
Window Ledge	1.64 (.01-.015)	2.35 (.012)	43.3 (.002-.003)

[a] Displacement in inches, time in seconds after impact

[b] Percent difference $= \frac{\text{analysis value - test value}}{\text{test value}} \times 100$

The analytical results indicate that lower fuselage deformation of up to 1.4 inches occurs, which appears to be approximately twice as high as the average deformation observed in the test high-speed film review. A review of the post-crash test condition of the structure indicates that overall deformation of the structure may not have exceeded 0.6 inches based on the average of the front and rear deformation.

The analysis shows that all the elements of the structure behave linearly, except for the seat cushion and pan, the fuselage underside and several elements of the shell structure (beams 7-13, 8-14, 9-15, 10-16, 11-17 and 12-18, Figure 2-3). The postcrash condition of the substructure indicates little in the way of permanent structural deformation. The analysis results show a Dynamic Response Index (DRI) value of 28. A DRI magnitude of 28 indicates a high potential ($\gg$50 percent) for a spinal vertebrae compression-type injury to occur. The available test data do not allow for an assessment of this type of injury potential.

Variation of the analytical filter cutoff frequency has no effect on the motion results since filtering is a post-processing procedure in KRASH and does not alter any of the basic results.

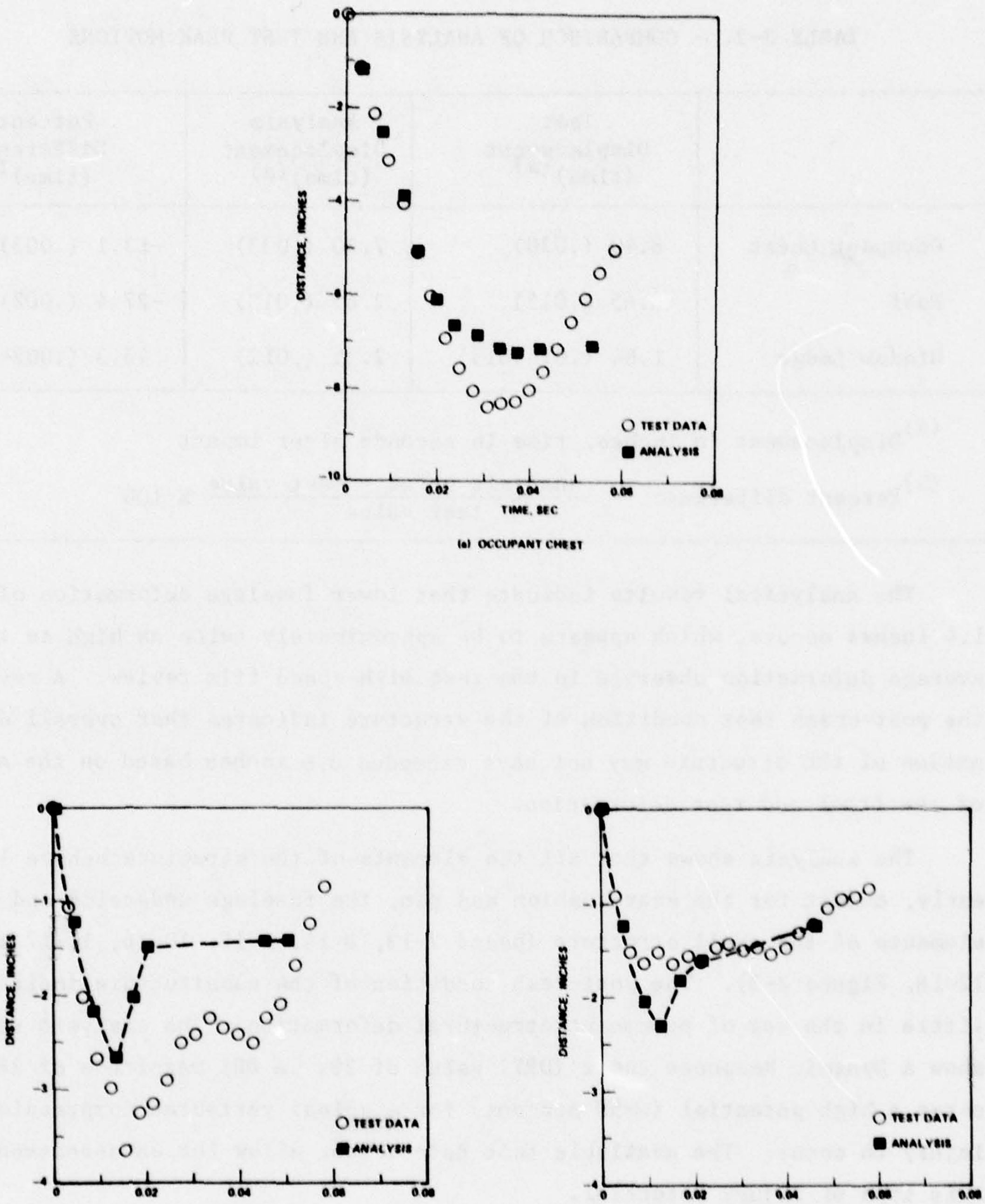


Figure 3-4. - Comparison of analysis and test motions.

3.3 COMPUTER COST AND PERFORMANCES

The KRASH analysis was performed on an IBM 370-3330 digital computer. For the size case and impact condition analyzed (see Section 2.0) the approximate cost per computer run is $135. The analysis (machine) time, including all printed and plotted data, is 6.9 minutes per run.

SECTION 4

KRASH SENSITIVITY STUDY RESULTS

An analysis using program KRASH is based on the premises that:

- Nonlinear load-deflection behavior can be approximated
- Only a portion of the major structural elements need be modeled nonlinearly for post-failure behavior.

Since the use of KRASH is designed to obtain overall responses, depict significant dynamic phenomenon, and represent response trends using approximate modeling techniques, it is understandable that different users might model aircraft structure or select input data which varies in some respects. To determine the consequence, insofar as dynamic response results are concerned, of establishing a model and an analysis which might vary, a limited sensitivity investigation was performed. The base case results which best represent the estimated properties of the structure and occupant are described in Section 3.0. In this section the results of varying the following parameters are discussed:

- External spring load-deflection representation
- Occupant axial stiffness
- Seat maximum force level
- Analytical filter cutoff frequency selection
- Math model size

There was little in the way of nonlinear behavior, other than in the crushable lower fuselage, occupant seat cushion and pan deflection, and several elements in the airframe shell, noted in the analysis of the substructure for the defined impact condition. Consequently, the above noted parameters are considered representative of areas wherein different users may have differences of opinion with regard to modeling representations.

4.1 EXTERNAL SPRING LOAD-DEFLECTION REPRESENTATION

The representation of the crushable lower fuselage structure within the framework of KRASH's external spring input requirements is perhaps the most sensitive and critical concern for modeling. The data for the base case representation were obtained following the procedures outlined in References 4 and 5. A sample calculation is shown in Appendix A. The most likely area of variation in a user's thinking would be in the representation of the slope of the load-deflection curve in the nonlinear region. The base case assumes a constant load in the nonlinear region until bottoming occurs. This curve (condition A) is shown in Figure 4-1, along with possible user input variations. Condition B provides for a constant 20-percent increase in the assumed maximum forces associated with the crushable structure. Conditions C and D represent sloping 20-percent force changes (increasing and decreasing, respectively) up until bottoming occurs. All the curves are based on a 0.1-inch initial linear region and a 3-inch deflection before bottoming occurs. Both values are determined following the procedure outlined in References 4 and 5. The results would not be altered to any significant degree if the linear deflection value were in the range of 0.01 to as much as 0.3 inch, which leaves significant margin for modeling variation. Since the maximum deflection of the crushable structure in the base analysis does not exceed 1.6 inches the selection of 3 inches for bottoming to occur, is also of little consequence in this analysis. Thus, it is reasonable to assume that the selection of the peak force and the rate at which force varies with deflection will be most influential on the results for this analysis. The results of this parameter sensitivity investigation are shown in Figure 4-2. The 20-percent constant increase in external spring force maximum load results in an approximately 15 to 20-percent increase in peak floor accelerations at the four floor dc channel accelerometer locations. Changing the slope (conditions C and D) has a substantially less effect on the peak responses. The sloping ±20 percent change results in a variation of the peak floor accelerations of between ±3 to ±11 percent. The occupant pelvis responses are not affected by these changes because in this model and under the defined impact conditions the pelvis responses are influenced primarily by the seat and occupant

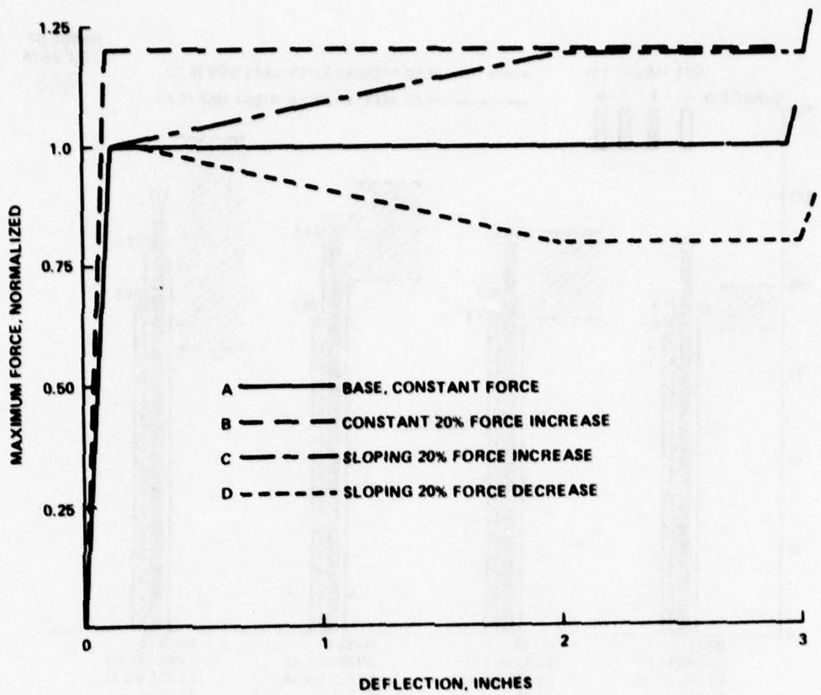


Figure 4-1. - Normalized force versus external spring load-deflection characteristics.

characteristics. As can be anticipated, the maximum deflection of the external spring decreases as the force level increases and vice versa. For the range of external spring characteristics investigated, the average floor deformation ranges from 1 to 1.5 inches. The range of test-measured peak accelerations is also shown in Figure 4-2. The analysis results for the range of load-deflection behavior investigated are within the range of the measured ac and dc accelerometer data. When considering dc accelerometer data alone the analysis peak values are no more than 30 percent different than the test peak values except at the aft outboard floor location where the difference is 50 percent and the ac and dc accelerometers differ by 75 percent (using dc accelerometer values as base values). The results presented in Figure 4-2 indicate that the sensitivity of the analysis results are comparable to the sensitivity of the test measurements. The results further indicate that all four external spring

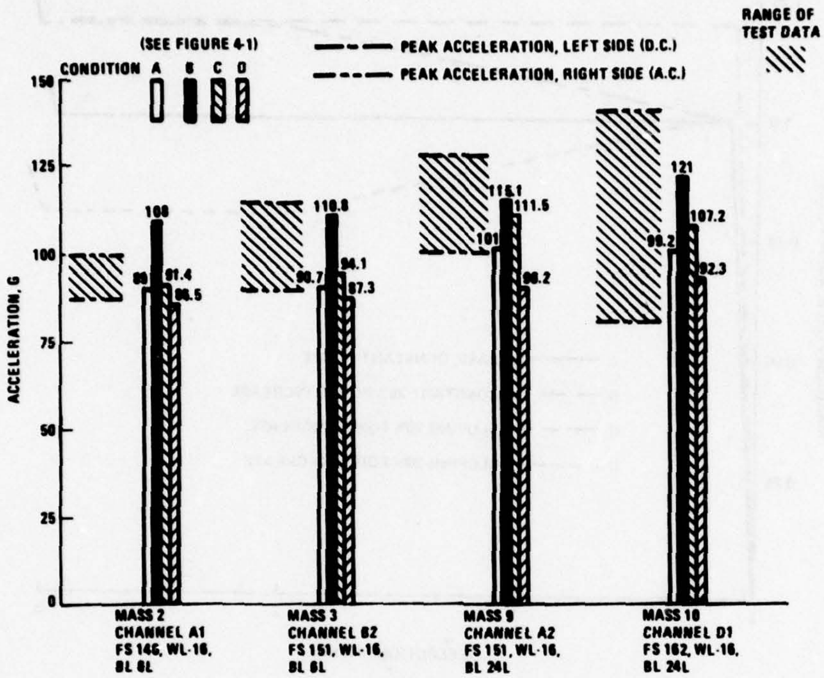


Figure 4-2. - Peak acceleration as a function of external spring load-deflection characteristics.

load-deflection curves, which can be considered to represent four different users, "on the average" represent the dynamic behavior of the structure reasonably well.

4.2 OCCUPANT AXIAL STIFFNESS REPRESENTATION

The representation of the occupant is controlled by the user in program KRASH by the selection of mass, area, and damping properties assigned to the corresponding masses and beam elements. The lower and upper torso masses (30 to 31 in Figure 2-4) are assigned mass weight and inertia properties as described in References 5 and 6 and in Appendix A. The connecting link between masses 31 and 32 represents the properties of the upper spine. The axial stiffness of this element is determined from the area, modulus of elasticity, and length properties assigned to this element. The data in Reference 7 suggest that the human upper torso has specific frequency and damping values.

Translated into KRASH data this requires the axial frequency and the damping of the human spine to be 14 Hz and 41 percent of critical, respectively. Depending on the actual properties of the anthropomorphic dummy used in a particular test it is possible that the frequency and/or the damping can be different than the values suggested for humans. In this particular case the spinal axial stiffness is not defined for the dummies used in the test.

For the human properties defined in Reference 7, KRASH is coded to compute the desired frequency and damping. For all other spinal stiffness, the user can easily determine the proper values to input. Knowing the desired frequency, the input mass values, and the length of the spinal element, combinations of modulus of elasticity and cross section area may be determined for input into KRASH. Damping, as a percent of critical, can be user selected for any individual element.

To evaluate the consequence of different spinal axial properties on the response of the structure and occupant, a variation in upper torso axial frequency from 14 to 61 Hz was examined. The results of this investigation are presented in Figure 4-3. As shown in Figure 4-3, as the axial frequency increases the analytical results tend to reproduce the two peaks (camel hump) effect exhibited in the test data for the occupant lower torso. Using an axial frequency, of 61 Hz., a maximum seat force of 5570 pounds and 0.41 damping the analysis results are 20 to 30 percent lower than the test data. For a higher seat force, the occupant lower torso acceleration values increase. For a lower axial stiffness the occupant lower torso initial peak value increases while the second peak value decreases, until it actually goes negative at 14 Hz. Changing the damping value while holding all other parameters constant tends to affect the second peak value more than the initial peak value. During a separate study using a simplified 5-mass system, changing damping from 0.31 to 0.04 increased the occupant lower torso first peak value by 2.5 percent and the second peak value by 29 percent.

The parameter sensitivity analyses involving the occupant representation illustrates the importance of providing input data representative of the elements being modeled. It may well be that the properties of test dummies

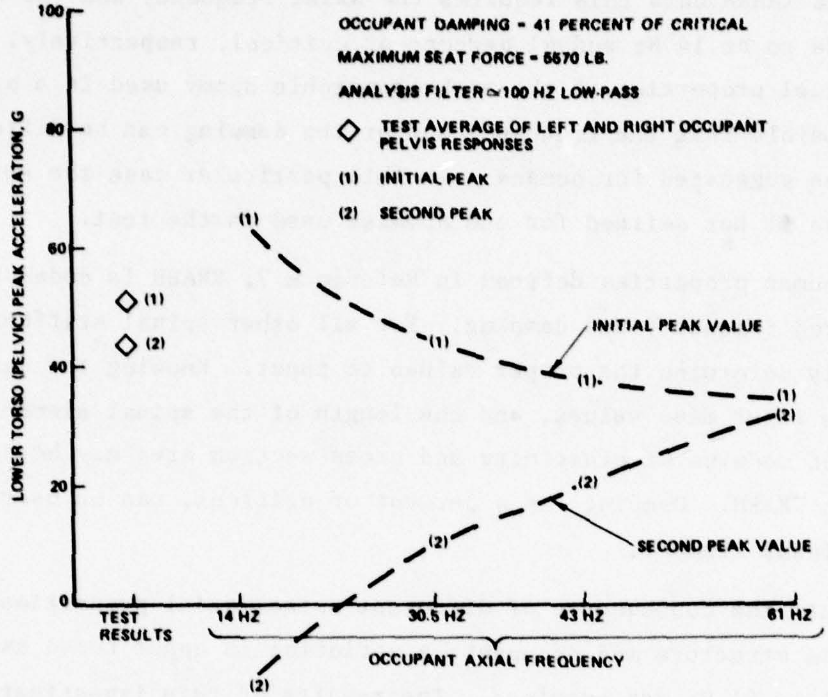


Figure 4-3. - Lower torso (pelvis) response as a function of occupant axial stiffness

differ from the corresponding human properties. It appears from the results of this investigation that the "camel hump" effect noted in the test data means that the dummy spine is stiffer than originally anticipated in setting up a representation based on Reference 7 data. The fact that the occupant upper torso responses follow very closely the occupant lower torso responses in both magnitude and time of occurrence, supports the contention that the spinal connection of the dummies used in the substructure test are relatively stiff.

4.3 SEAT MAXIMUM FORCE

The seat-cushion and pan-stiffness properties used in the analysis are representative of those installed in the particular type of airplane used in the substructure test. Figure 4-4 shows a general force-deflection curve for a light aircraft passenger seat. Since the curve provided in Figure 4-4

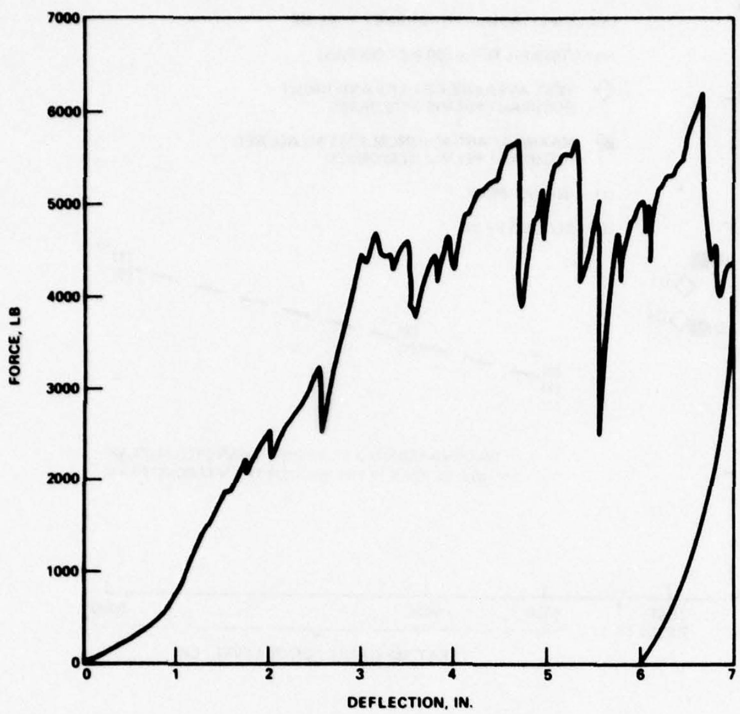


Figure 4-4. - Typical force-deflection curve for a light-aircraft passenger seat.

is not the actual load-deflection for the seat installation in the substructure test, an investigation into the effect of the variation in maximum seat force on occupant response was performed. The change in cushion and pan stiffness effects the occupant response to a lesser extent than the force cutoff value in this particular situation and was not fully explored. Figure 4-5 shows the results of the force cutoff changes. The occupant pelvis responses increase as the maximum force level increases. For a maximum cutoff force of 5570 pounds the analysis results are approximately 30 to 19 percent lower than the average of the measured responses for the two peak accelerations. For the 6455 pounds used in the base analysis the analytical results are approximately 19 and 7 percent lower than the average of the measured responses for the two peak accelerations. If the cutoff force was as high as 9000 pounds, the analytical results would be 8 and 18 percent higher than the average of the

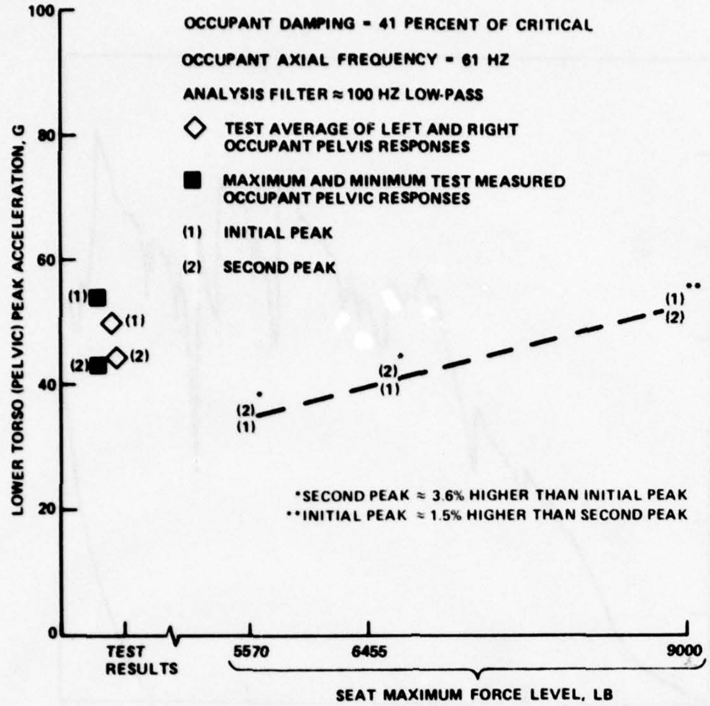


Figure 4-5. - Lower torso (pelvis) response as a function of seat maximum force level.

measured responses. The ranges investigated represent a deviation of approximately -15 to +28 percent from the nominal 6455 pounds used. For the three force levels evaluated (5570, 6455, and 9000 pounds), the initial peak acceleration level obtained by analysis for the occupant upper torso is approximately 6 percent, 17.4 percent, and 58 percent higher, respectively, than the corresponding average of the head and chest measured values. The upper torso response is more akin to the DRI value than the lower torso response. Consequently, the analysis may show a more conservative DRI value than is indicated by test response data. User-selected values of between 5500 and 6500 pounds appear to provide reasonable representations of the seat load-deflection characteristics.

4.4 ANALYTICAL FILTER CUTOFF FREQUENCY

Analysis of the current substructure test data indicated that a 100-Hz, low-pass digital filter is approximately equivalent to the least-square-fit (LSF) filtering performed by NASA-Langley. The LSF data were used for the tabulation of test results. Previous NASA evaluation of equivalent filtering

indicated that 180 Hz, low-pass filtering could be equivalent to the LSF data. Recognizing that equivalent filtering is difficult to define because of the different data reduction processes that are used and the wide range of types of structures or elements being considered, an evaluation was performed to ascertain the effects of the analytical results and subsequent correlation with test results of different analytical filter cutoff frequencies. As noted earlier, KRASH filtering is a post-processing technique and doesn't change any computed values.

Figure 4-6 shows the result of the analysis for a cutoff frequency range from 100 to 150 Hz. For the floor responses the analytically obtained peak values increase by approximately 4 to 18 percent in changing from a 100-Hz to 150-Hz cutoff frequency. However, as can be observed in Figure 4-6, the results are for the most part still within the range of recorded test values at the respective locations. The analytical responses for the occupant lower torso are less sensitive to the cutoff frequency change. The data in Figure 4-6 shows a variation of less than 5 percent for the initial lower torso peak value and less than 2 percent for the second peak value. The occupant responses exhibit lower frequency (broader response) characteristics than the floor responses and consequently are not expected to be as sensitive to the higher cutoff frequencies.

4.5 MODEL SIZE VARIATION

The base 32 mass, 57 member symmetrical math model shown in Figures 2-3 and 2-4 provides an adequate representation of the substructure and impact condition evaluated, as attested to by the close agreement with available test data. The results, analytical and test, indicate that the airframe shell structure, which accounts for approximately 28 percent of the total substructure airframe weight, did not deform appreciably, due in part to the stabilizing effect of the end closures (tension rods), during the 27.5 ft/sec vertical impact. Consequently, the occupant responses may not be altered very much from that which would be expected if the upper shell structure flexibility were ignored and the mass and inertia effects were accounted for. This situation is particularly significant since the 32 mass, 57 member model and test results show that the shell structure motion does not pose any lethal threat to the

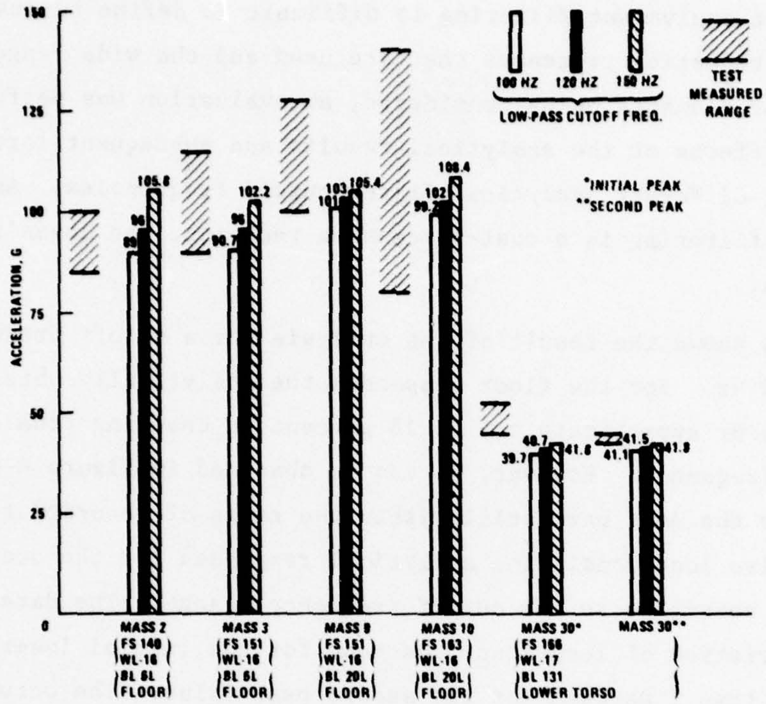


Figure 4-6. Floor and occupant peak responses as a function of analysis filter cutoff frequency.

occupants either through failure or excessive motion. If prior to or during the analysis, the user can establish that the representation of the shell structure is not critical, insofar as the occupant and floor responses are concerned, a smaller more economical math model can be pursued. To assess the tradeoff between accuracv and model analvsis cost for the substructure and impact condition described in this report the following KRASH math models were investigated:

- 16 mass, 32 member symmetrical half structure (runmod=1)
- 6 mass, 8 member symmetrical half structure (runmod=1)
- 5 mass, 5 member full structure (runmod=0)

The 16 mass, 32 member model is shown in Figure 4-7. The model is the same as the base 32 mass, 57 member model except that the mass associated with the shell structure is distributed among the floor masses. The 6 mass,

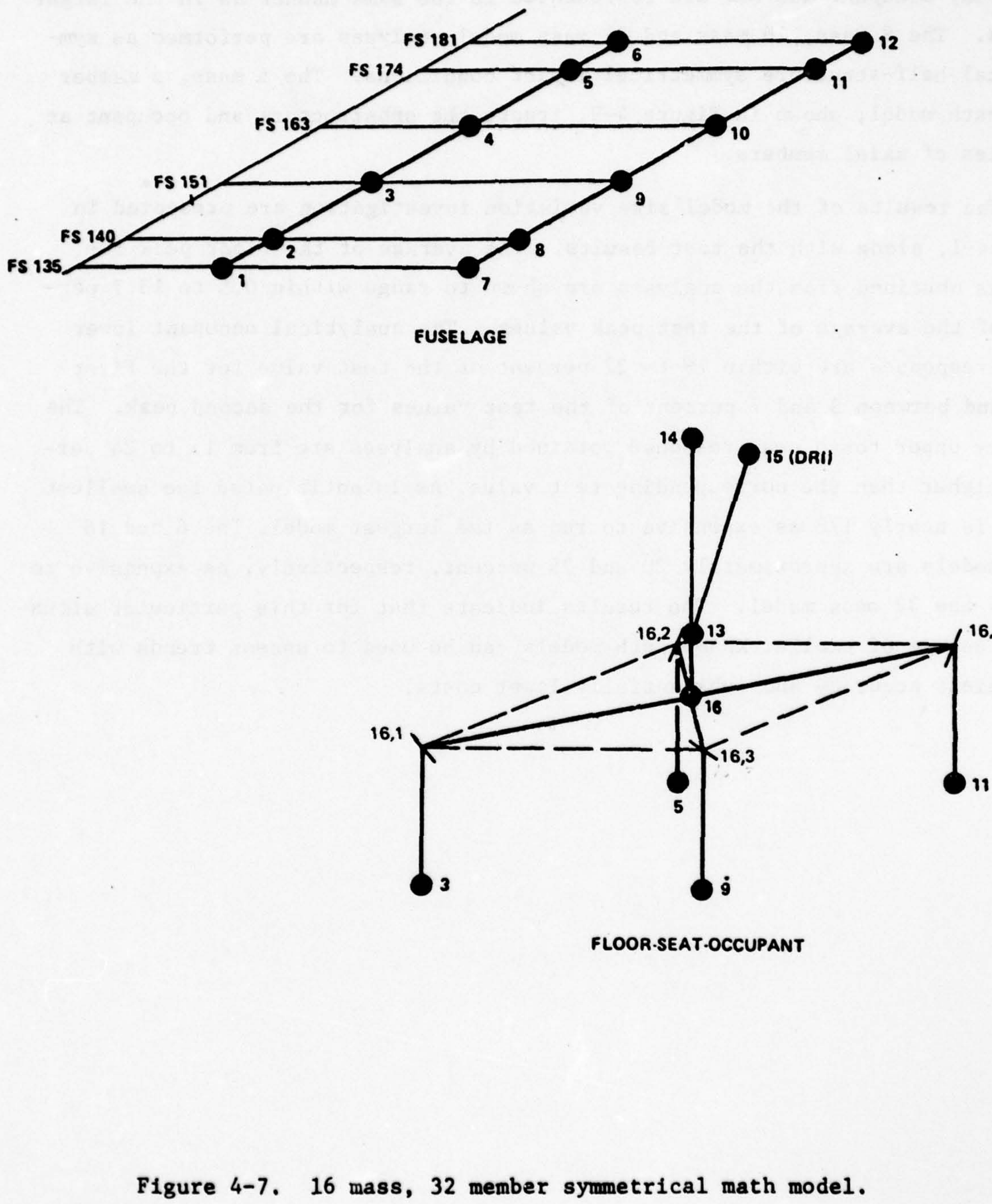


Figure 4-7. 16 mass, 32 member symmetrical math model.

8 member model, shown in Figure 4-8, lumps half the airframe weight at mass locations 1 and 2. The stiffness of the seat is represented by 2 members instead of 4 as in the larger 16 mass and 32 mass models. The seat cushion, seat pan, occupant and DRI are represented in the same manner as in the larger models. The 8 mass, 16 mass and 32 mass model analyses are performed as symmetrical half-structure symmetrical impact conditions. The 5 mass, 5 member full math model, shown in Figure 4-9, treats the substructure and occupant as a series of axial members.

The results of the model size variation investigation are presented in Table 4-1, along with the test results. The average of the floor peak responses obtained from the analyses are shown to range within 0.5 to 13.7 percent of the average of the test peak values. The analytical occupant lower torso responses are within 19 to 22 percent of the test value for the first peak and between 3 and 7 percent of the test values for the second peak. The primary upper torso peak response obtained by analyses are from 15 to 24 percent higher than the corresponding test value. As is anticipated the smallest model is nearly 1/8 as expensive to run as the largest model. The 6 and 16 mass models are approximately 20 and 75 percent, respectively, as expensive to run as the 32 mass model. The results indicate that for this particular situation the use of smaller KRASH math models can be used to assess trends with sufficient accuracy and substantially lower costs.

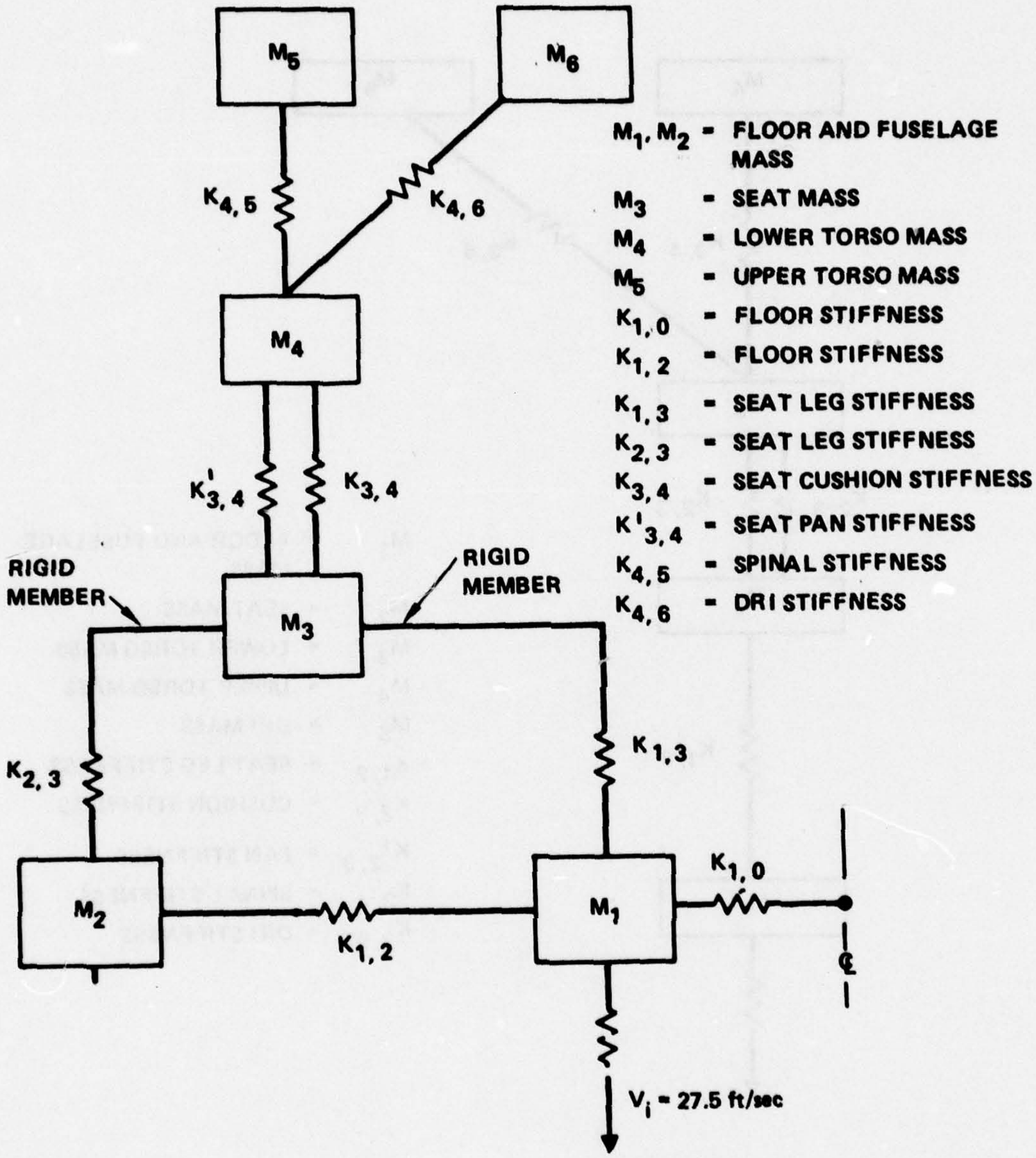
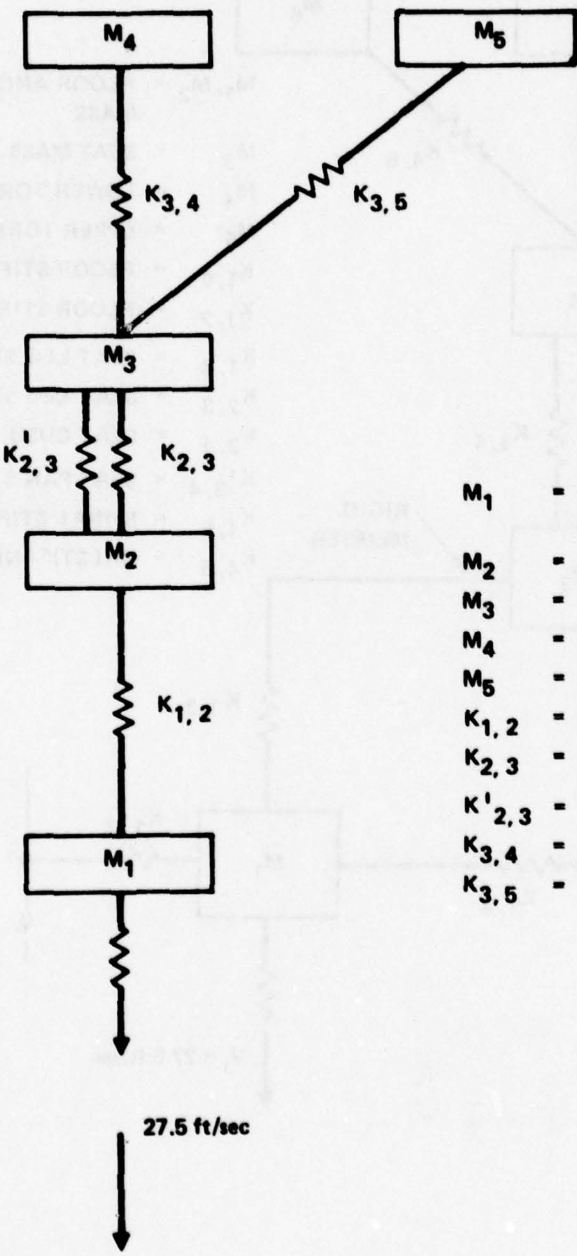


Figure 4-8. 6 mass, 8 member symmetrical math model.



M_1 = FLOOR AND FUSELAGE MASS
M_2 = SEAT MASS
M_3 = LOWER TORSO MASS
M_4 = UPPER TORSO MASS
M_5 = DRI MASS
$K_{1,2}$ = SEAT LEG STIFFNESS
$K_{2,3}$ = CUSHION STIFFNESS
$K'_{2,3}$ = PAN STIFFNESS
$K_{3,4}$ = SPINAL STIFFNESS
$K_{3,5}$ = DRI STIFFNESS

Figure 4-9. 5 mass, 5 member full math model.

TABLE 4-1. COMPARISON OF RESULTS FOR DIFFERENT SIZE MATH MODELS[a]

Location		Analysis Results (Peak Acceleration - g)[b]				Test Results (Peak Acceleration - g)[b]
	Masses Beams	32 57	16 32	6 8	5 5	
Floor		89(.004) 90.7(.004) 101(.011) 99.2(.004)	91.2(.005) 92.6(.007) 94(.011) 98.5(.007)	99(.005) 105(.008)	88.5(.008)	84.9(.004) 128.7(.010) 115.7(.004) 80.8(.008)
Average (Time Range)		95(.004-.011)	94(.005-.011)	102(.005-.008)	88.5(.008)	102.5(.004-.010)
Lower Torso		39.7(.017) 41.1(.026)	38.4(.018) 38.4(.027)	39.8(.017) 42. (.028)	39.7(.017) 45.4(.030)	49(.018-.020) 44.1(.030-.032)
Upper Torso		50.5(.022)	49.5(.022)	50.8(.022)	53.5(.019)	43(.020)[c]
Analysis Time (Machine Minutes)[d]		6.9	4.75	1.1	.67	---
Approximate Cost[d]		$135	$91	$26	$17	---

(a) Analysis results are based on 85 Hz low-pass filter, 27.5 ft/sec vertical velocity, 0.131 radian nose-up pitch, ≈6500 pound seat force cutoff, and integration interval = .00001 seconds

(b) Time of occurrence in seconds after impact is shown in parenthesis

(c) *Averaging of head and chest values*

(d) Based on IBM 370-3330 digital computer

SECTION 5

CONCLUSIONS

The analysis of a twin-engine, low-wing airplane substructure subjected to a 27.5 ft/sec vertical impact has demonstrated program KRASH's capability to quantitatively represent the significant dynamic response phenomena, namely:

- Primary floor acceleration magnitudes and times of occurrence
- Occupant response magnitudes, time of occurrence and response shape, particularly the "camel-hump" effect
- Occupant and structure motion trends

The results of the sensitivity investigation using program KRASH indicate that for the parameters varied, the structure, and the impact condition evaluated, user-selected data for input into KRASH can vary as much as 20 percent and still provide a reasonable assessment of overall dynamic behavior. Furthermore, the range of dynamic response peak values obtained from variations in KRASH user selected input data is comparable to the spread in the measured test data between the left and right sides.

The results of the test and analysis correlation and sensitivity studies provide valuable information which can be used to enhance future modeling of crash impact conditions.

For some structural configurations and impact conditions simple approximate models are a cost-effective method of representing large structural segments with acceptable accuracy for qualitatively assessing dynamic behavior and response trends.

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APPENDIX A
KRASH MODEL CALCULATIONS

This appendix provides the sample calculations for determining the structure and occupant mass locations, mass properties, beam properties, and the external spring load-deflection characteristics.

LOCKHEED
CALIFORNIA COMPANY

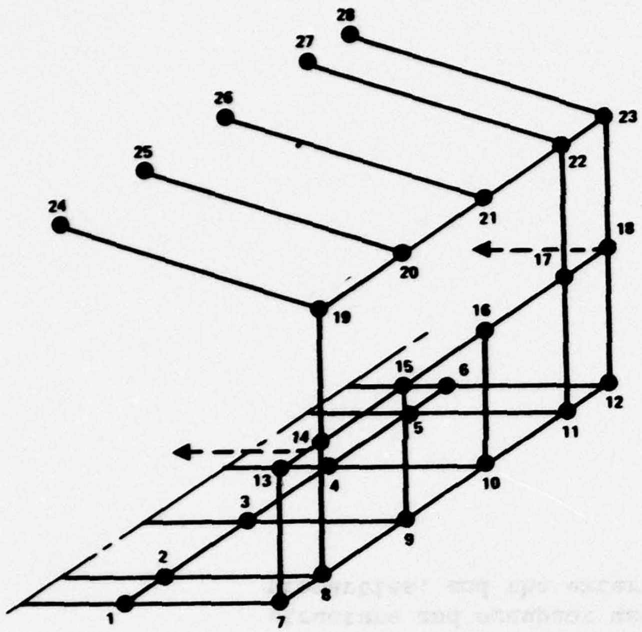


Figure A-1. – Fuselage model.

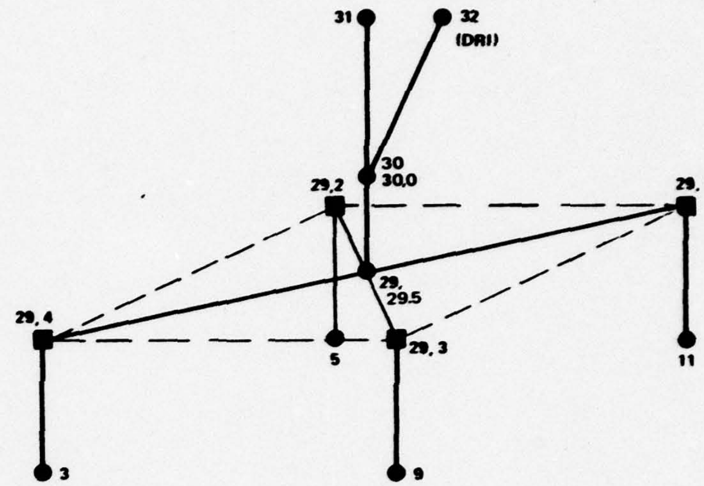


Figure A-2. – Floor seat-occupant model.

SEAT-OCCUPANT-REPRESENTATION

MASS REPRESENTATIONS

Mass	Representation	Weight (lb)	$\bar{X}$ (3)
3, 5, 9, 11	Seat leg attachment at floor	(1)	0
29,1, 29,2, 29,3, 29,4	Seat leg attachment at pan	20.86	14.3
30	Lower torso pelvis region	72.86 (2)	21.8
31	Upper torso chest region	72.86 (2)	36.9
32	DRI	72.86 (2)	36.9

MEMBER REPRESENTATIONS

$i^{th} - j^{th}$ Masses	Representation
3 - 29,1	Seat legs
5 - 29,2	Seat legs
9 - 29,3	Seat legs
11 - 29,4	Seat legs
29 - 30	Seat cushion, compression only member
29,5 - 30,1	Seat pan
30 - 31	Upper torso (spine)
30 - 32	DRI
11 - 30	Seat belt, tension only member
5 - 30	Seat belt, tension only member

Notes

(1) Distributed weight from floor structure +6 percent of occupant weight at each of the forward floor seat leg attachment locations.

(2) 44 percent of occupant weight

(3) Height in inches above the floor

MASS MOMENT OF INERTIA OF 50-PERCENTILE MAN, 161.5 lb (Reference 6)

Element	Fraction of Total Mass (m/m_T)	Weight (lb)	Mass lb sec^2 in.	Mass Moment of Inertia ($lb - sec^2 - in.$) Roll I_x	Pitch I_y	Yaw I_z
Lower Torso	0.2778	44.86	0.1162	8.703	4.331	8.703
Upper Torso	0.2264	36.56	0.09471	3.357	2.623	2.623
Head & Neck	0.0792	12.79	0.03313	0.311	0.311	0.201
Upper Arm	0.0264	4.26 (2)	0.01104	0.164	0.164	0.0241
Forearm & Hand	0.0214	3.46 (2)	0.00896	0.0241	0.218	0.218
Thigh	0.1001	16.17 (2)	0.04189	0.307	1.270	1.270
Leg & Foot	0.0604	9.75 (2)	0.02526	1.192	1.192	0.120
Total		161.5	0.41334			

UPPER TORSO 50-PERCENTILE MAN, 161.5 lb (Reference 6)

$$I_x = 3.357 + 2\left\{.164 + .01104\left[(5.81 - 5.24)^2 + (6.34)^2\right]\right\} + 2\left\{.0241 + .00896\left[(11.99 = 5.81)^2 + (6.34)^2\right]\right\}$$

$$+ .311 + .03313\left[(5.81 + 6.06)^2\right] = 3.357 + 1.2227 + 1.4529 + 4.9789 = \underline{11.0115}$$

$$I_y = 2.623 + 2\left\{.164 + .01104\left[(5.81 - 5.24)^2\right]\right\} + 2\left\{.218 + .00896\left[(11.99 - 5.81)^2 + (8.95)^2\right]\right\}$$

$$+ .311 + .03313\left[(5.81 + 6.06)^2 + (.75)^2\right] = 2.623 + .3352 + 2.5559 + 4.9976 = \underline{10.5117}$$

$$I_z = 2.623 + 2\left\{.0241 + .01104\left[(6.34)^2\right]\right\} + 2\left\{.218 + .00896\left[(6.34)^2 + (8.95)^2\right]\right\} + .201 + .03313\ (75)^2$$

$$= 2.623 + .93572 + 2.59174 + .21964 = \underline{6.3701}$$

For 165.6 # MAN

$I_x = 11.2946$

$I_y = 10.7785$

$I_z = 6.5318$

LOWER TORSO 50-PERCENTILE MAN, 161.5 lb

$$I_x = 8.703 + .1162\,(5.35)^2 + 2\left\{.307 + .04189\,(3.39)^2\right\} = 8.703 + 3.3259 + 1.57681 = \underline{13.6057}$$

$$I_y = 4.331 + .1162\,(5.35)^2 + 2\left\{1.270 + .04189\,(7.09)^2\right\} = 4.331 + 3.3259 + 6.7515 = \underline{14.4084}$$

$$I_z = 8.703 + .1162\,(0) + 2\left\{1.270 + .04189\,\left[(3.39)^2 + (7.09)^2\right]\right\} = 8.703 + 0 + 7.71427 = \underline{16.4173}$$

For 165.6 lb Man

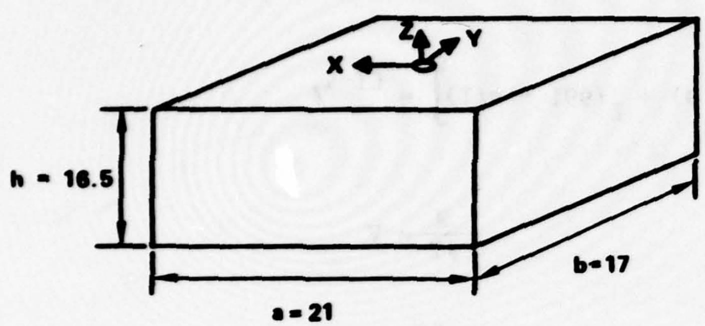
$I_x = \underline{13.9511}$

$I_y = \underline{14.7742}$

$I_z = \underline{16.8341}$

MASS MOMENT OF INERTIA OF SEAT (MASS 29)

Mass = 20/386



$$I_x' = \frac{20}{12(386)}\,(17^2 + 16.5^2) = 2.4234$$

$$I_y' = \frac{20}{12(386)}\,(21^2 + 16.5^2) = 3.0797$$

$$I_z' = \frac{20}{12(386)}\,(21^2 + 17^2) = 3.1520$$

About Top Center

$$I_x = 2.4234 + \frac{20}{386}\left(\frac{16.5}{2}\right)^2 = 5.9500$$

$$I_y = 3.0797 + \frac{20}{386}\left(\frac{16.5}{2}\right)^2 = 6.6062$$

$$I_z = 3.1520$$

SEAT BELT

Seat Belt Attaches from Mass 30 to Mass 11 and from Mass 30 to Mass 5

Estimated stiffness of seat belt = 1000 lb/in.

For the purpose of seat belt calculations assume the seat belt material to be aluminum - material #4

$$E = 10.5 \times 10^6$$

$$K = \frac{AE}{\ell}$$

$$A = \frac{K\ell}{E}$$

$$\ell_{5-13} = \left[(174 - 166)^2 + (6 - 13)^2 + (-16 - 4)^2\right]^{1/2} = 22.6495$$

$$\ell_{11-13} = \left[(174 - 166)^2 + (20 - 13)^2 + (-16 - 4)^2\right]^{1/2} = 22.6495$$

$$A = \frac{(1 \times 10^3)(22.6495)}{10.5 \times 10^6} = .0021571$$

SEAT CUSHION

Estimated seat cushion stiffness = 500 lb/in.

For the purpose of seat cushion calculations assume the cushion material to be aluminum - material #4 $E = 10.5 \times 10^6$.

$$K = \frac{AE}{\ell} \qquad\qquad A = \frac{K\ell}{E}$$

Assume thickness of cushion to be 4"

$$A = \frac{(500)(4)}{(10.5 \times 10^6)} = .00019 \ (in^2)$$

Estimated seat pan stiffness = 2000 lb/in.

$$A = \frac{K\ell}{E} = \frac{(2000)(4)}{(10.5 \times 10^6)} = .0007619 \ (in^2)$$

EXTERNAL SPRING REPRESENTATION

STIFFENER AREA - MASSES 2 THROUGH 6

AREA = (12)(.032) + (a + b)(.032)

= (12 + a + b)(.032)

Δ = AREA/REF AREA*

REF. AREA = 3.376 (in^2)

F.S.	a	b	A	Δ	Peak Load at Deflection = 0.1 inch
135	0	2.5	0.464	0.137	1644
140	2.5	0.65	0.645	0.191	2292
151.3	5.65	5.65	0.746	0.221	2652
162.6	5.65	5.7	0.747	0.221	2652
174	5.7	3.5	0.678	0.201	2412
184	3.5	0	0.496	0.147	1764

BULKHEAD AREA - MASSES 8 THROUGH 12

Reference Area = .956 *

Area = (14 - 6) (.032) = .256

Δ = .268

Peak load = 670 lb at a deflection = .05 inches

*Reference Area based on USAAMRDL TR 74-12 TEST SPECIMEN DATA. See Reference FAA-RD-77-188II, page 4-62.

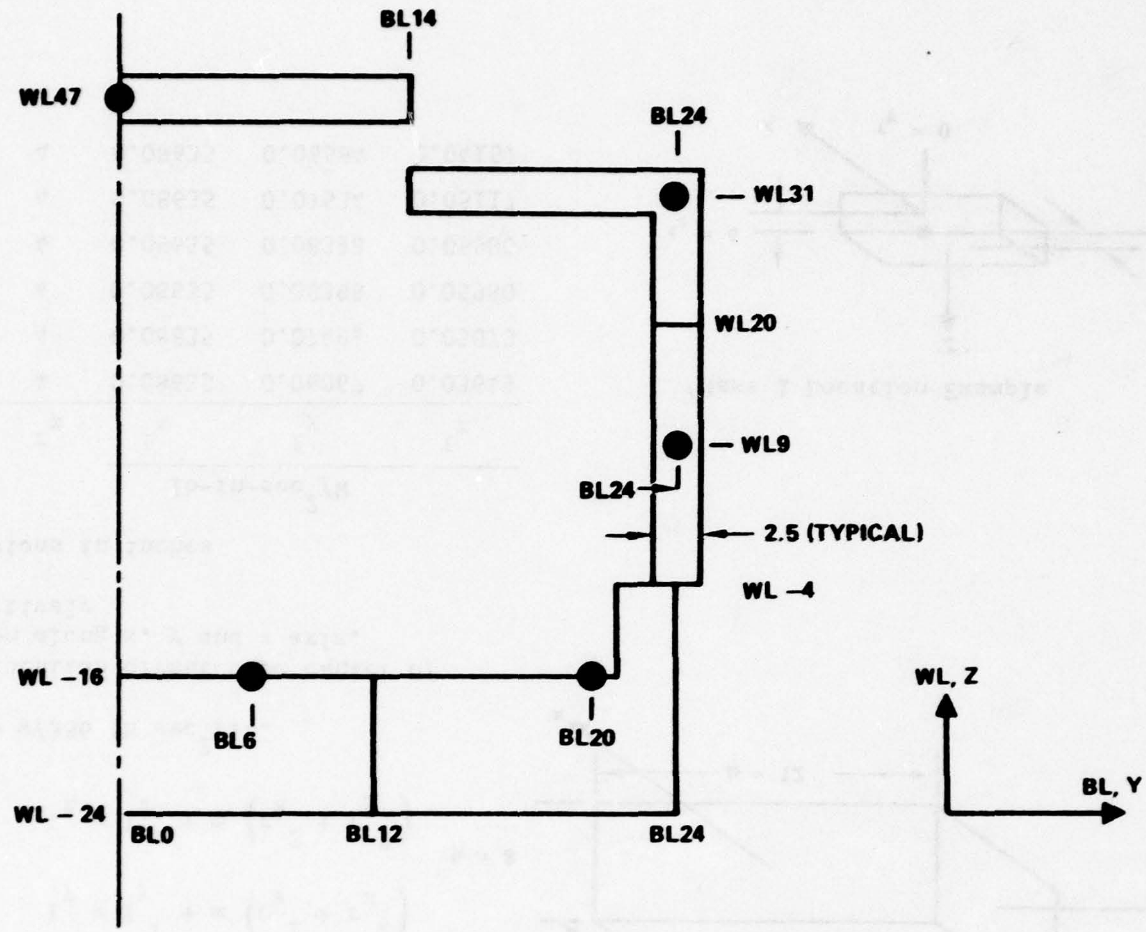


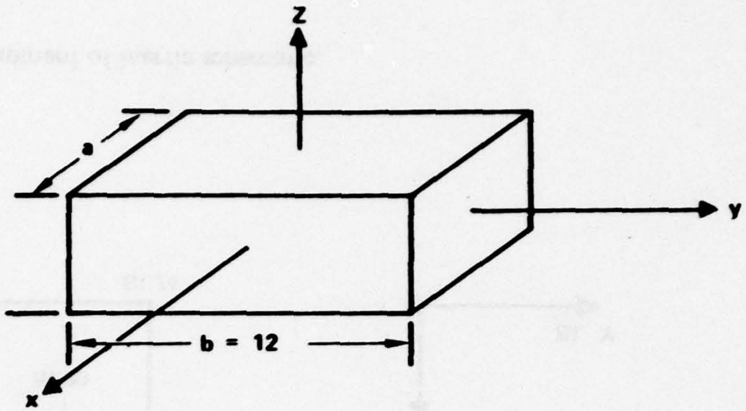
Figure A-3. – Mass moment of inertia schematic.

MASSES 1-6

$$I_x' = \frac{m}{12}\left(b^2 + h^2\right) \qquad I_x = I_x' + m\left(r_z^{\,2} + r_y^{\,2}\right)$$

$$I_y' = \frac{m}{12}\left(a^2 + h^2\right) \qquad I_y = I_y' + m\left(r_x^{\,2} + r_z^{\,2}\right)$$

$$I_z' = \frac{m}{12}\left(b^2 + a^2\right) \qquad I_z = I_z' + m\left(r_x^{\,2} + r_y^{\,2}\right)$$



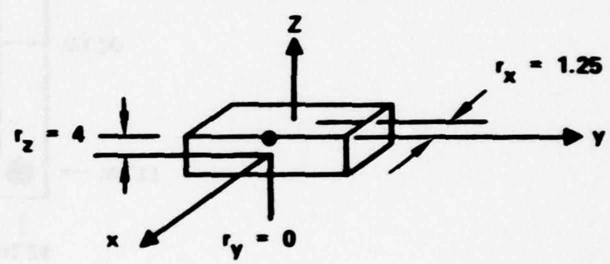
m = mass = w/386 lb sec^2/in.

r_x, r_y, r_z = mass location offset from center of section along x, y and z axis, respectively

a, b, h = dimensions in inches

Mass	a	r_x	r_y	r_z	I_x (lb-in-sec^2/W)	I_y	I_z
*1	2.5	1.25	0	4	0.08635	0.06067	0.03649
2	8.0	1.5	0	4	0.08635	0.07491	0.05073
3	11.5	0.25	0	4	0.08635	0.08398	0.05980
4	11.5	0.25	0	4	0.08635	0.08398	0.05980
5	9	1.	0	4	0.08635	0.07534	0.05117
6	3.5	1.75	0	4	0.08635	0.06584	0.04167

*Mass 1 Location Example



MASSES 7-12

$$I_{1x}' = \frac{m}{12}\left(b_1^2 + h_1^2\right) \qquad I_{2x}' = \frac{m}{12}\left(b_2^2 + h_2^2\right)$$

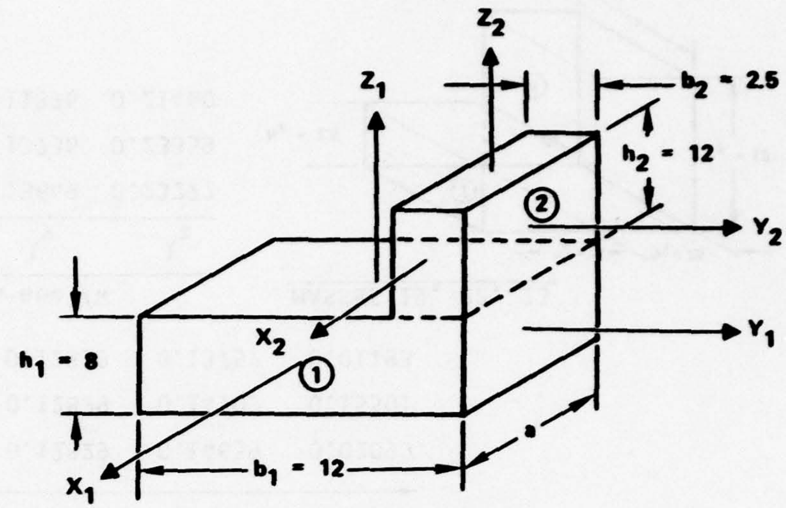
$$I_{1y}' = \frac{m}{12}\left(a^2 + h_1^2\right) \qquad I_{2y}' = \frac{m}{12}\left(a^2 + h_2^2\right)$$

$$I_{1z}' = \frac{m}{12}\left(a^2 + b_1^2\right) \qquad I_{2z}' = \frac{m}{12}\left(a^2 + b_2^2\right)$$

$$I_x = I_{1x}' + m\left(r_{1z}^2 + r_{1y}^2\right) + I_{2x}' + m\left(r_{1z}^2 + r_{1y}^2\right)$$

$$I_y = I_{1y}' + m\left(r_{1x}^2 + r_{1z}^2\right) + I_{2y}' + m\left(r_{1x}^2 + r_{1z}^2\right)$$

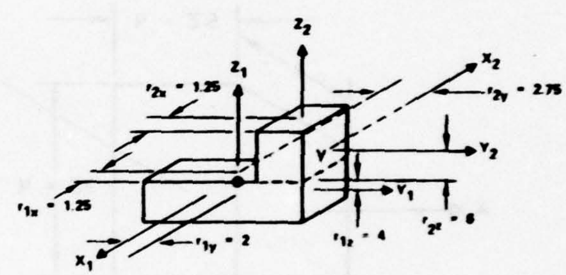
$$I_z = I_{1z}' + m\left(r_{1x}^2 + r_{1y}^2\right) + I_{2z}' + m\left(r_{1x}^2 + r_{1y}^2\right)$$



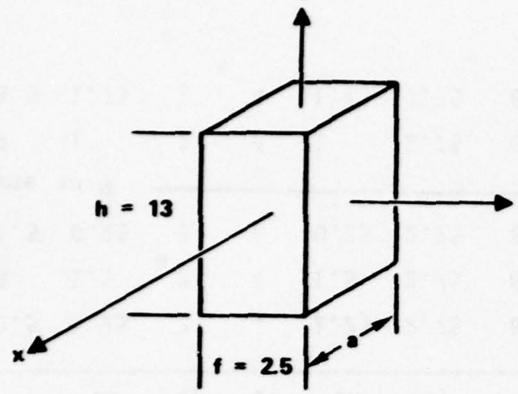
SKETCH B

Mass	a	r_{1x}	r_{1y}	r_{1z}	r_{2x}	r_{2y}	r_{2z}	I_x (lb-in-sec²/W)	I_y (lb-in-sec²/W)	I_z (lb-in-sec²/W)
* 7	2.5	1.25	2	4	1.25	2.75	6	0.245	0.19042	0.0732
8	8	1.5	2	4	1.5	2.75	6	0.242	0.2189	0.13808
9	11.5	0.25	2	4	0.25	2.75	6	0.242	0.23705	0.11982
10	Same as 9 →									
11	9	1	2	4	1	2.75	6	0.245	0.21974	0.10255
12	3.5	1.75	2	4	1.75	2.75	6	0.245	0.20077	0.08356

*Mass 7 Location Example

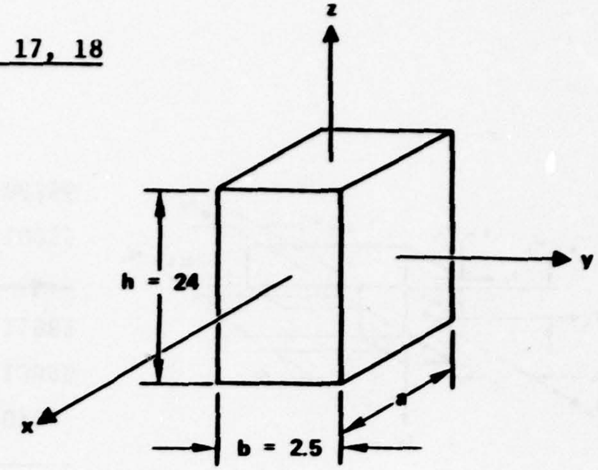


MASSES 13, 15, 16



SKETCH C

MASSES 14, 17, 18

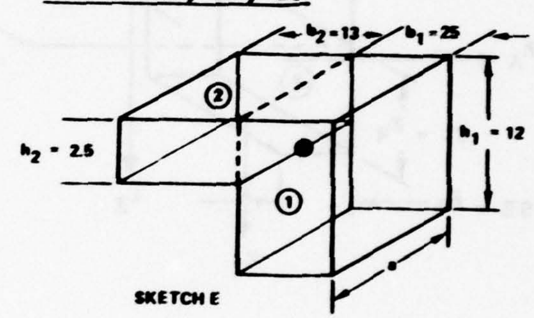


SKETCH D

Mass	a	r_x	r_y	r_z	I_x (lb-in-sec^2/W)	I_y (lb-in-sec^2/W)	I_z (lb-in-sec^2/W)
13	2.5	1.25	0	6.5	0.14728	0.15134	0.00675
15	11.5	0.25	0	6.5	0.14728	0.17465	0.03006
16	Same as 15 →						
14	8	1.5	0	1	0.12829	0.14659	0.02099
17	9	1	0	1	0.12829	0.14702	0.15501
18	3.5	1.75	0	1	0.12829	0.13752	0.01193

MASS	a	r_{1x}	r_{1y}	r_{1z}	r_{2x}	r_{2y}	r_{2z}	I_x (lb-in-sec^2/W)	I_y (lb-in-sec^2/W)	I_z (lb-in-sec^2/W)
19	8	1.5	0	5	1.5	7.75	0	0.29064	0.13649	0.23272
22	9	1.0	0	5	1	7.75	0	0.29064	0.13736	0.23359
23	3.5	1.75	0	5	1.75	7.75	0	0.29064	0.11836	0.21460

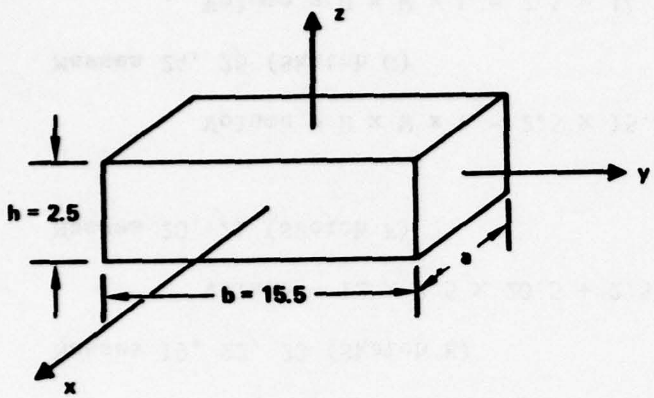
MASSES 19, 22, 23

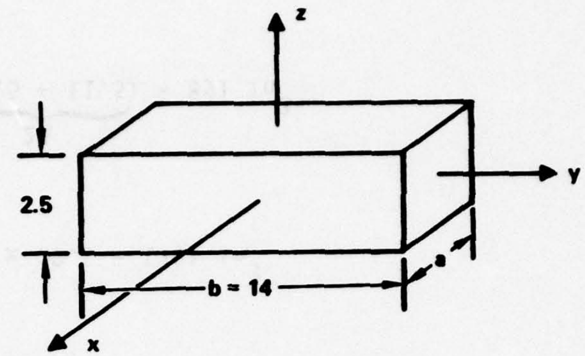


SKETCH E

MASSES 20, 21

MASSES 24-28





SKETCH F

SKETCH G

Mass	a	r_x	r_y	r_z	I_x (lb-in sec^2/W)	I_y (lb-in sec^2/W)	I_z (lb-in sec^2/W)
20	11.5	0.25	6.5	0	0.16267	0.08058	0.13952
21	Same as 20 →						
24	8	1.5	7	0	0.17061	0.021	0.1889
25	11.5	0.25	7	0	0.17061	0.03006	0.19797
26	Same as 25 →						
27	9	1	7	0	0.17061	0.2143	0.18933
28	3.5	1.75	7	0	0.17061	0.01193	0.17983

MASS DISTRIBUTION BASED ON VOLUME

Masses 1-6 (Sketch A)

$$\text{Volume} = H \times W \times L = 8 \times 12 \times \overbrace{(2.5 + 8 + 11.5 + 11.5 + 9 + 3.5)}^{46} = 4416 \text{ in}^3$$

Masses 7-12 (Sketch B)

$$\text{Volume} = 8 \times 12 \times 46 + 2.5 \times 12 \times 46 = 5796 \text{ in}^3$$

Masses 13, 15, 16 (Sketch C)

$$\text{Volume} = H \times W \times L = 13 \times 2.5 \times \overbrace{(2.5 + 11.5 + 11.5)}^{25.5} = 828.75 \text{ in}^3$$

Masses 14, 17, 18 (Sketch D)

$$\text{Volume} = H \times W \times L = 24 \times 2.5 \times \underbrace{(8 + 9 + 3.5)}_{20.5} = 1230 \text{ in}^3$$

Masses 19, 22, 23 (Sketch E)

$$\text{Volume} = 12 \times 2.5 \times 20.5 + 2.5 \times 13 \times 20.5 = 1281 \text{ in}^3$$

Masses 20, 21 (Sketch F)

$$\text{Volume} = H \times W \times L = 2.5 \times 15.5 \overbrace{(11.5 + 11.5)}^{23} = 891 \text{ in}^3$$

Masses 24, 28 (Sketch G)

$$\text{Volume} = H \times W \times L = 2.5 \times 14 \times 46 = 1610 \text{ in}^3$$

Total Volume = 16053.25 in^3

Density of Aluminum = $0.1\ \text{lb/in}^3$

Assume 5% of volume is structure

$$\text{Weight} = 16053.25 \times 0.1 \times 0.05 = 80.265\ \text{lb}$$

Actual Weight = 86.5 lb for half

$$\Delta\,\text{Weight} = 86.5 - 80.265 = 6.235\ \text{lb}$$

Assume weight on floor is slightly heavier

$$\text{Volume of floor structure masses 1-12} = 0.05\ [(8 \times 12 \times 46)2] = 441.6\ \text{in}^3$$

$$\Delta\,\text{Density} = 6.235/441.6 = 0.014119\ \text{lb/in}^3$$

Weight Calculations

Masses 1-6

$$\text{Weight} = (8)(12)(0.05)(0.1 + 0.04119)a = 0.54768a$$

Masses 7-12

$$\text{Weight} = (8)(12)(0.05)(0.1 + 0.04119)a + 12(2.5)(0.5)(0.1)a = 0.69768a$$

Masses 13, 15, 16

$$\text{Weight} = 13\ (0.25)(0.05)(0.1)a = 0.1625a$$

Masses 14, 17, 18

$$\text{Weight} = 2.5\ (24)(0.05)(0.1)a = 0.3a$$

Masses 19, 22, 23

$$\text{Weight} = 2.5(12)(0.05)\ 0.1a + 13\ (2.5)(0.05)(0.1)a = 0.3125a$$

Masses 20, 21

$$\text{Weight} = (15.5)(2.5)(0.05)(0.1)a = 0.19375a$$

Masses 24-28

$$\text{Weight} = 14(2.5)(0.05)(0.1)a = 0.175a$$

See Table V-1 for appropriate mass "a" values (lengths) and weights

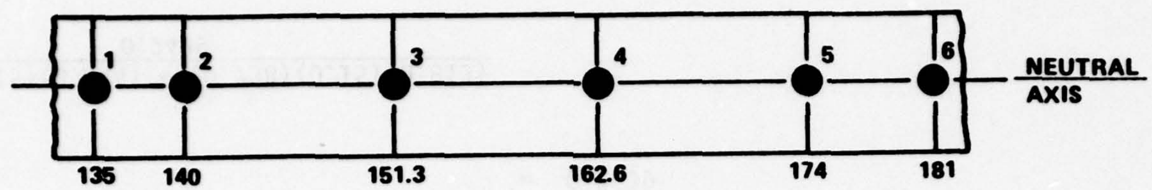
TABLE V-1. – MASS LOCATIONS AND PROPERTIES

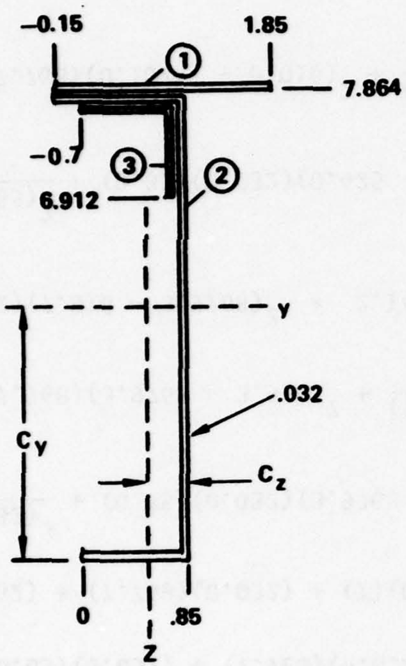
Mass No.	a in.	x (in.)	y (in.)	z (in.)	WT LB.	I_x	I_y (lb-in-sec^2)	I_z
1	2.5	135	6	-16	1.37	0.1183	0.0831	0.05
2	8	140	6	-16	4.38	0.3782	0.328	0.222
3*	11.5	151	6	-16	16.3	4.34	4.4	0.5
4	11.5	163	6	-16	6.3	0.544	0.529	0.377
5	9.	174	6	-16	4.93	0.426	0.371	0.252
6	3.5	181	6	-16	1.91	0.165	0.126	0.0796
7	2.5	135	20	-16	1.75	0.429	0.333	0.128
8	8	140	20	-16	5.58	1.35	1.22	0.771
9*	11.5	151	20	-16	18.03	5.72	5.68	1.09
10	11.5	163	20	-16	8.02	1.94	1.9	0.961
11	9	174	20	-16	6.28	1.54	1.38	0.644
12	3.5	181	20	-16	2.44	0.598	0.49	0.204
13	2.5	135	28	9	0.41	0.06	0.062	0.0028
14	8	140	28	9	2.4	0.308	0.352	0.0504
15	11.5	151	28	9	1.87	0.275	0.326	0.0562
16	11.5	163	28	9	1.87	0.275	0.326	0.0562
17	9	174	28	9	2.7	0.346	0.397	0.4185
18	3.5	181	28	9	1.05	0.134	0.144	0.0125
19	8	140	28	31	2.05	0.595	0.2798	0.477
20	11.5	151	28	31	2.23	0.362	0.1797	0.311
21	11.5	163	28	31	2.23	0.362	0.1797	0.311
22	9	174	28	31	2.81	0.8167	0.386	0.656
23	3.5	181	28	31	1.1	0.319	0.13	0.236
24	8	140	0	47.0	2.8	0.477	0.059	0.529
25	11.5	151	0	47.0	4.02	0.686	0.1206	0.796
26	11.5	163	0	47.0	4.02	0.686	0.1206	0.796
27	9	174	0	47.0	3.15	0.537	0.0675	0.596
28	3.5	181	0	47.0	1.23	0.21	0.0147	0.221
29	-	166	13	-1.7		Seat		
30	-	166	13	5.7		Cushion - Lower Torso		
31	-	166	13	20.89		Upper Torso		
32	-	166	13	20.89		DRI		

*Includes weight and inertia for occupant legs

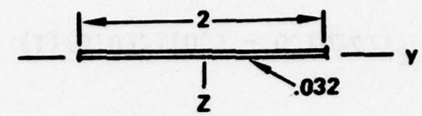
BEAM PROPERTIES

LONGITUDINAL BEAM ASSEMBLY AREA PROPERTIES - MEMBERS 1-2, 2-3, 3-4, 4-5, 5-6





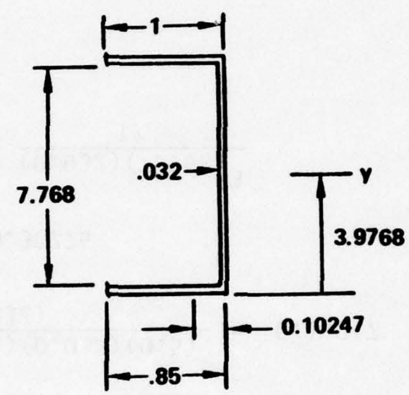
1



$$I_y = \frac{(2)(0.032)^3}{12} = 5.4613 \times 10^{-6}$$

$$I_z = \frac{(0.032)(2)^3}{12} = 0.021333$$

2



② $$C_y = \frac{(0.85)(0.032)(0.016) + (7.768)(0.032)(3.916) + (0.032)(1)(7.816)}{(0.85)(0.032) + (7.768)(0.032) + (1)(0.032)} = 3.9768$$

$$C_z = \frac{(0.85)(0.032)(0.425) + (7.768)(0.032)(0.016) + (1)(0.032)(0.5)}{(0.85)(0.032) + (7.768)(0.032) + (1)(0.032)} = 0.10247$$

$$A = (0.85)(0.032) + (7.768)(0.032) + (1)(0.032) = 0.30776$$

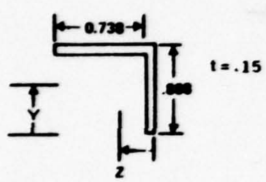
$$I_y = \frac{(0.85)(0.032)^3}{12} + (0.85)(0.032)(3.9768 - 0.016)^2 + \frac{(0.032)(7.768)^3}{12}$$

$$+ (0.032)(7.768)(3.9768 - 3.916)^2 + \frac{(1)(0.032)^3}{12}$$

$$+ (1)(0.032)(7.816 - 3.9768)^2 = 2.14926$$

$$I_z = \frac{(0.032)(0.85)^3}{12} + (0.85)(0.032)(0.425 - 0.10247)^2 + \frac{(7.768)(0.032)^2}{12}$$

$$+ (0.032)(7.768)(0.1024) - 0.016)^2 + \frac{(0.032)(1)^3}{12} + (1)(0.032)(0.5 - 0.10247)^2 = 0.0140706$$

③ 

$$A = (0.888)(0.15) + (0.738)(0.15)$$

$$= 0.2439$$

$$C_y = \frac{(0.888)(0.15)(0.444) + (0.738)(0.15)(0.813)}{0.2439}$$

$$C_y = 0.61148$$

$$C_z = 0.27652$$

$$I_y = \frac{(0.15)(0.855)^2}{12} + (0.888)(0.15)(0.61148 - 0.444)^2 + \frac{(0.738)(0.15)^3}{12} + (0.738)(0.15)(0.813 - 0.61148)^2$$

$$= 0.017192$$

$$I_z = \frac{(0.885)(0.15)^3}{12} + (0.888)(0.15)(0.27652 - 0.075)^2 + \frac{(0.15)(0.738)^3}{12} + (0.738)(0.15)(0.519 - 0.27652)^2$$

$$= 0.017192$$

<u>**Total**</u>

$$A_T = 0.064 + 0.307776 + 0.2439 = 0.615674$$

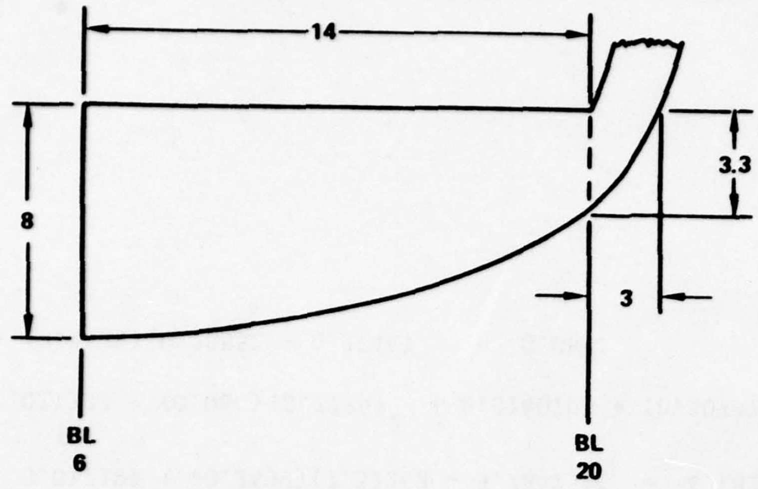
$$C_y = \frac{(0.064)(7.848) + (0.307776)(3.9768) + (0.2439)(7.52348)}{0.615674} = 5.78425$$

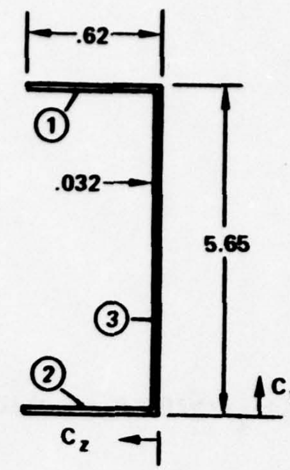
$$C_z = \frac{(0.064)(0) + (0.307776)(0.10247) + (0.2439)(0.30852)}{0.615674} = 0.27740$$

$$I_y = 5.4613 \times 10^{-6} + (0.064)(7.848 - 5.78425)^2 + 2.14926 + (0.307776)(5.78425 - 3.9768)^2$$
$$+ 0.017192 + (0.2439)(7.52348 - 5.78425)^2 = 4.18228$$

$$I_z = 0.021333 + (0.064)(0.2774)^2 + 0.0140706 + (0.307776)(0.2744 - 0.10247)^2 + 0.017192$$
$$+ (0.2439)(0.30852 - 0.2744)^2 = 0.0671$$

FUSELAGE STATION 135 - 181 - MEMBERS 1-7, 2-8, 3-9, 4-10, 5-11, 6-12





$$\text{Average Section Height} = \frac{8 + 3.3}{2} = 5.65$$

$$\text{Area} = 2(0.62)(0.032) + (5.686)(0.032)$$
$$= 0.21843$$

① and ② $\quad A = 0.01984$

$$C_y = 0.016$$

$$C_z = 0.31$$

$$I_y = \frac{0.62(0.032)^3}{12} = 1.693 \times 10^{-6}$$

$$I_z = \frac{0.032(0.62)^3}{12} = 6.3554 \times 10^{-4}$$

3 $A = (5.586)(0.032) = 0.17875$

$C_y = 2.793$

$C_z = 0.016$

$$I_y = \frac{0.032(5.586)^3}{12} = 0.46481$$

$$I_z = \frac{5.586(0.032)^3}{12} = 1.5254 \times 10^{-5}$$

<u>**Total Section**</u>

$A = 0.21843$

$$C_y = \frac{(0.01984)(5.634) + (0.01984)(0.016) + (0.17875)(2.825)}{0.21843} = 2.825$$

$$C_z = \frac{(2)(0.01984)(0.31) + (0.17875)(0.016)}{0.21843} = 0.06941$$

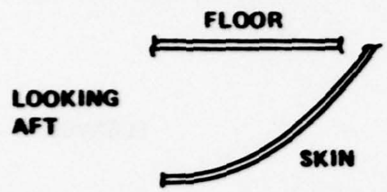
$$I_y = 1.693 \times 10^{-6} + (0.01984)(5.634 - 2.825)^2 + 0.46481 + (0.17875)(0) + 1.693 \times 10^{-6}$$

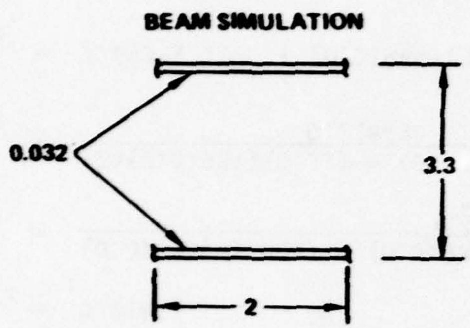
$$+ (0.01984)(2.825 - 0.016)^2 = 0.77791$$

$$I_z = (6.3554 \times 10^{-4})(2) + (2)(0.01984)(0.31 - 0.06941)^2 + 1.5254 \times 10^{-5} + (0.17875)(0.06941 - 0.016)^2$$

$$= 0.0040931$$

STRUCTURE BETWEEN RINGS - MEMBERS - 7-8, 8-9, 9-10, 10-11, 11-12





$$A = (2)(2)(0.032) = 0.128$$

$$C_y = 1.65$$

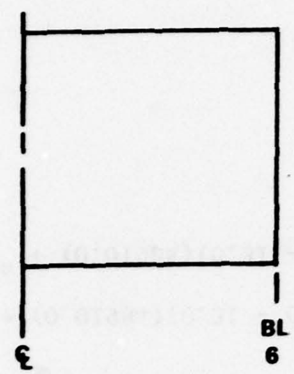
$$C_z = 1.0$$

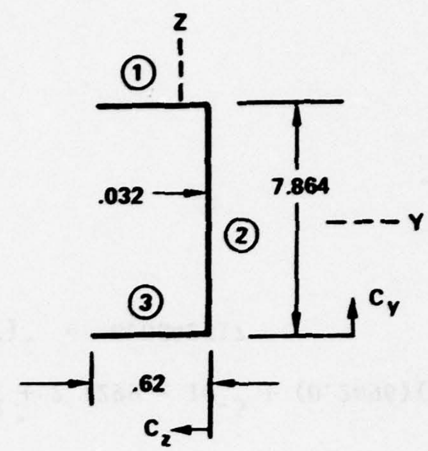
$$I_y = 2\left[\frac{(2)(0.032)^3}{12} + (0.064)(1.634)^2\right]$$

$$= 0.34176$$

$$I_z = (2)\ \frac{(0.032)(2)^3}{12} = 0.042667$$

FUSELAGE STATION 135 - 181 - MEMBERS 1-0, 2-0, 3-0, 4-0, 5-0, 6-0





1 , 3 $A = (0.62)(0.032) = 0.01984$

$C_y = 0.016$

$C_z = 0.31$

$$I_y = \frac{(0.62)(0.032)^3}{12} = 1.6930 \times 10^{-6}$$

$$I_z = \frac{(0.032)(0.62)^3}{12} = 6.3554 \times 10^{-4}$$

2 $A = (7.8)(0.032) = 0.2496$

$C_y = 3.9$

$C_z = 0.016$

$$I_y = \frac{(0.032)(7.8)^3}{12} = 1.2655$$

$$I_z = \frac{(7.8)(0.032)^3}{12} = 2.1299 \times 10^5$$

Total

$$A = 2(0.01984) + 0.2496 = 0.28928$$

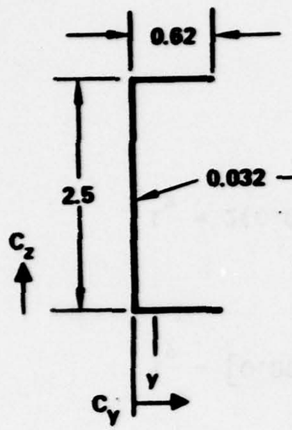
$$C_y = \frac{(0.01984)(0.016) + (0.2456)(3.932) + (0.01984)(7.848)}{0.28928} = 3.932$$

$$C_z = \frac{(2)(0.31)(0.01984) + (0.2496)(0.016)}{0.28928} = 0.056327$$

$$I_y = 1.6930 \times 10^{-6} + (0.01984)(3.932 - 0.016)^2 + 1.2655 + (0.2496)(3.932 - 3.932)^2$$
$$+ 1.6930 \times 10^{-6} + (0.01984)(7.848 - 3.932)^2 = 1.87400$$

$$I_z = 6.3554 \times 10^{-4} + (0.01984)(0.31 - 0.056327)^2 + 2.1299 \times 10^{-5} + (0.2496)(0.056327 - 0.016)^2$$
$$+ 6.3554 \times 10^{-4} + (0.01984)(0.31 - 0.056327)^2 = 0.0042517$$

BEAMS 7-13, 8-14, 9-15, 10-16, 12-18, 17-22, 18-23



$$A = 2\,(0.62)(0.032) + (2.5 - 0.064)(0.032) = 0.11763$$

$$C_z = 1.25$$

$$C_y = \frac{2(0.62)(0.032)(0.31) + (2.5 - 0.064)(0.032)(0.016)}{0.11763} = 0.11517$$

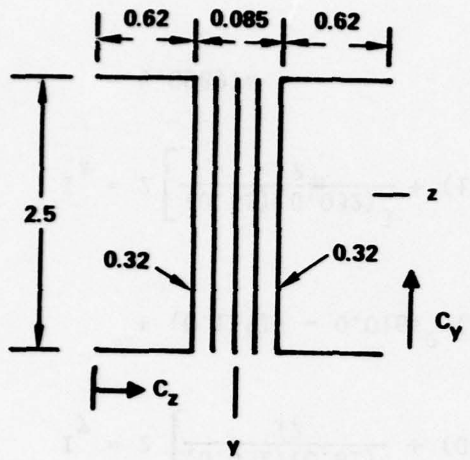
$$I_y = 2\left[\frac{(0.032)(0.62)^3}{12} + (0.31 - 0.11517)^2\,(0.62)(0.032)\right] + \frac{(2.5 - 0.064)(0.032)^3}{12}$$

$$+ (0.11517 - 0.016)^2\,(2.5 - 0.064)(0.032) = 0.0035506$$

$$I_z = 2\left[\frac{(0.62)(0.032)^3}{12} + (1.25 - 0.016)^2\,(0.62)(0.032)\right] + \frac{(0.032)(2.5 - 0.064)^3}{12}$$

$$= 0.098974$$

BEAM 11-17



$$A = 4(0.62)(0.032) + 2(2.5 - 0.064)(0.032)$$

$$+ (0.085)(2.5) = 0.44776$$

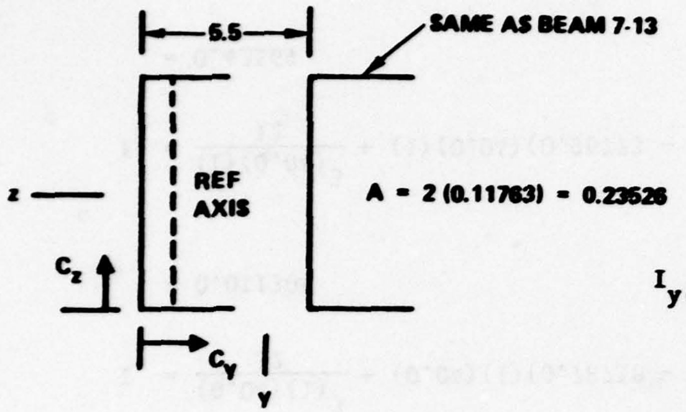
$$C_y = 1.25$$

$$C_z = 0.6625$$

$$I_y = \left[0.0035506 + (0.11517 + 0.0425)^2\ (0.11763)\right]\ (2) + \frac{(2.5)(0.085)^3}{12} = 0.013077$$

$$I_z = 2(0.098974) + \frac{(0.085)(2.5)^3}{12} = 0.308625$$

BEAM 14-19



$$C_y = \frac{(0.11763)(0.11517) + (0.11763)(0.11517 + 5.5)}{0.23526}$$

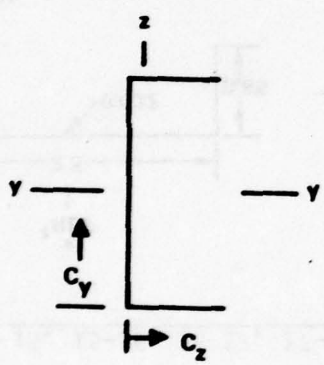
$$= 3.09396$$

$$C_z = 1.25$$

$$I_{y(\text{REF AXIS})} = (0.0035506)(2) + (0.11763)(5.5)^2 = 3.56541$$

$$I_z = 2(0.098974) = 0.197948$$

BEAMS 19-24, 20-25, 21-26, 22-27, 23-28 (See Beam 7-13)



$$A = 0.11763$$

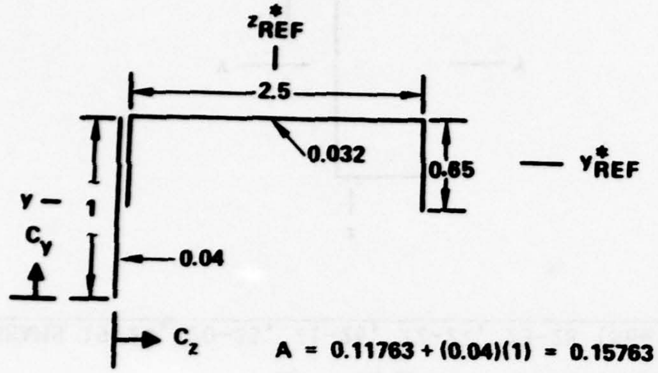
$$C_y = 1.25$$

$$C_z = 0.11517$$

$$I_y = 0.098974$$

$$I_z = 0.0035506$$

BEAMS 13-14, 14-15, 15-16, 16-17, 17-18



A = 0.11763 + (0.04)(1) = 0.15763

*z_{REF} = 1.25, y_{REF} = 0.11517, FROM BEAM 7-13 DATA

$$A = 0.11763 + (0.04)(1) = 0.15763$$

$$C_y = \frac{(1)(0.04)(0.5) + (0.11763)(1 - 0.11517)}{0.11763 + 0.04} = 0.78718$$

$$C_z = \frac{(1)(0.04)(0.02) + (1.25 + 0.04)(0.11763)}{0.15763} = 0.96773$$

$$I_y = \frac{(0.04)(1)^3}{12} + (0.04)(1)(0.78718 - 0.5)^2 + 0.0035506 + (0.11763)(1 - 0.11517 - 0.78718)^2$$

$$= 0.011304$$

$$I_z = \frac{(1)(0.04)^3}{12} + (1)(0.04)(0.96773 - 0.02)^2 + 0.098974 + (0.11763)(2.54 - 0.96773)^2$$

$$= 0.42569$$

APPENDIX B
ANALYSIS COMPUTER PRINT

This section contains the KRASH program print showing the math model input data, model parameter data, mass position plots and selected output data. The math input data consists of the following:

- Echo print
- Program size and control data
- Initial conditions
- Mass, mode point, external spring, and beam data

The model parameter data provides the following:

- Vechicle weight, cg, inertia and initial ground impact position
- Beam loads, deflections, uncoupled frequences, damping terms and Euler angles.

The time-equal-zero data consists of the following:

- Mass accelerations
- Vehicle cg *translational* velocity
- Energy distribution
- Mass energy deviation

The mass position plots at time = 0.0 are presented for the following:

- xz plane (aft-up)
- yz plane (side-up)

The selected output data consists of the following:

- Rupture/yield summary
- Energy summary
- Position plots at time = 0.054
- History plots of:
  A mass filtered and unfiltered acceleration
  A beam force and deflection
  An external spring
  The DRI element
  The vehicle cg translational velocity

ECHO DATA

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                   1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

      1                  SECTION DROP TEST SIMULATION                                  00000010
      2  MODEL NUMBER 3 (9-1-78)  PAN&CUSHION S'IFF.PER DATA                           00000020
      3  12345678901234567890123456789012345678901234567890123456789012345678901200000030
      4        32   10   57   44    0    0    0    1    0    0    0    0    0    10100000040
      5                                                                                 00000050
      6                                                                                 00000060
      7             100 0.00001   0.054     0.0       85.0         0    6 1.0      0  00000070
      8                                                                                 00000080
      9         0    0    0    0    0    0    0    6   10   50  100                     00000090
     10        19    0    7   21    0    5    1    5   18                               00000100
     11  0.0       0.0       330.0                                                      00000110
     12  0.0       0.0       0.0                                                        00000120
     13  0.0       0.0131    0.0       0.0       0.0       0.0                          00000130
     14  1.37      135.0     6.0       -16.0     0.11830   0.08312   0.04999            00000140
     15  4.38      140.0     6.0       -16.0     0.37822   0.32811   0.22220            00000150
     16  16.30     151.0     6.0       -16.0     4.34400   4.40000   0.50000            00000160
     17  6.30      163.0     6.0       -16.0     0.54401   0.52910   0.37674            00000170
     18  4.93      174.0     6.0       -16.0     0.42571   0.37143   0.25227            00000180
     19  1.91      181.0     6.0       -16.0     0.16540   0.12610   0.08000            00000190
     20  1.75      135.0     20.0      -16.0     0.42750   0.33230   0.12772            00000200
     21  5.58      140.0     20.0      -16.0     1.35040   1.22150   0.77050            00000210
     22  18.02     151.0     20.0      -16.0     5.72000   5.68000   1.09100            00000220
     23  8.02      163.0     20.0      -16.0     1.94210   1.90233   0.96161            00000230
     24  6.28      174.0     20.0      -16.0     1.54000   1.38000   0.64403            00000240
     25  2.44      181.0     20.0      -16.0     0.59700   0.48990   0.20385            00000250
     26  0.41      135.0     28.0      9.0       0.05960   0.06130   0.00273            00000260
     27  2.40      140.0     28.0      9.0       0.30790   0.35180   0.05038            00000270
     28  1.87      151.0     28.0      9.0       0.27542   0.32660   0.05620            00000280
     29  1.87      163.0     28.0      9.0       0.27542   0.32660   0.05620            00000290
     30  2.70      174.0     28.0      9.0       0.34639   0.39696   0.41853            00000300
     31  1.05      181.0     28.0      9.0       0.13471   0.14440   0.01253            00000310
     32  2.05      140.0     28.0      31.0      0.59560   0.27920   0.47700            00000320
     33  2.23      151.0     28.0      31.0      0.36276   0.17970   0.31113            00000330
     34  2.23      163.0     28.0      31.0      0.36276   0.17970   0.31113            00000340
     35  2.81      174.0     28.0      31.0      0.81670   0.38600   0.65640            00000350
     36  1.10      181.0     28.0      31.0      0.31850   0.12960   0.23500            00000360
     37  2.80      140.0     0.0       47.0      0.47800   0.05880   0.52892            00000370
     38  4.02      151.0     0.0       47.0      0.68585   0.12084   0.79584            00000380
     39  4.02      163.0     0.0       47.0      0.68585   0.12084   0.79584            00000390
     40  3.15      174.0     0.0       47.0      0.53742   0.06704   0.59639            00000400
     41  1.23      181.0     0.0       47.0      0.20985   0.01467   0.22119            00000410
     42  20.5      166.0     13.0      -1.7      5.95      6.6062    3.152              00000420
     43  72.86     166.0     13.0      5.8       13.9511   14.7742   16.8341            00000430
     44  72.86     166.0     13.0      20.89     11.3116   10.7989   6.5318             00000440
     45  72.86     166.0     13.0      20.89     11.3116   10.7989   6.5318             00000450
     46         1   29 151.0     6.0       -1.7                                         00000460
     47         2   29 174.0     6.0       -1.7                                         00000470
     48         3   29 151.0     20.0      -1.7                                         00000480
     49         4   29 174.0     20.0      -1.7                                         00000490
     50         5   29 166.0     13.       -1.7                                         00000500
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                  1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

   51         1  30 166.      13.       5.8                                         00000510
   52         2   3 8.0       0.0       50000.0                                     00000520
   53         3   3 8.0       0.0       50000.0                                     00000530
   54         4   3 8.0       0.0       50000.0                                     00000540
   55         5   3 8.0       0.0       50000.0                                     00000550
   56         6   3 8.0       0.0       50000.0                                     00000560
   57         8   3 3.3       0.0       20000.0                                     00000570
   58         9   3 3.3       0.0       20000.0                                     00000580
   59        10   3 3.3       0.0       20000.0                                     00000590
   60        11   3 3.3       0.0       20000.0                                     00000600
   61        12   3 3.3       0.0       20000.0                                     00000610
   62    0.100      0.700     1.000     2.5       2290.0    2290.0                  00000620
   63    0.100      0.700     1.000     2.5       2650.0    2650.0                  00000630
   64    0.100      0.700     1.000     2.5       2650.0    2650.0                  00000640
   65    0.100      0.700     1.000     2.5       2410.0    2410.0                  00000650
   66    0.100      0.700     1.000     2.5       1760.0    1760.0                  00000660
   67    0.045      0.055     0.15      1.1       1380.     1380.                   00000670
   68    0.045      0.055     0.15      1.1       1380.     1380.                   00000680
   69    0.045      0.055     0.15      1.1       1380.     1380.                   00000690
   70    0.045      0.055     0.15      1.1       1380.     1380.                   00000700
   71    0.045      0.055     0.15      1.1       1380.     1380.                   00000710
   72         1   2 0.615674            4.18228   0.060521            5.78 .667 400000720
   73         2   3 0.615674            4.18228   0.060521            5.78 .667 400000730
   74         3   4 0.615674            4.18228   0.060521            5.78 .667 400000740
   75         4   5 0.615674            4.18228   0.060521            5.78 .667 400000750
   76         5   6 0.615674            4.18228   0.060521            5.78 .667 400000760
   77         7   8 0.128               0.34176   0.042667            1.65 1.0  400000770
   78         8   9 0.128               0.34176   0.042667            1.65 1.0  400000780
   79         9  10 0.128               0.34176   0.042667            1.65 1.0  400000790
   80        10  11 0.128               0.34176   0.042667            1.65 1.0  400000800
   81        11  12 0.128               0.34176   0.042667            1.65 1.0  400000810
   82         1   0 0.28928             1.874     0.0042517           3.93 .564 400000820
   83         2   0 0.28928             1.874     0.0042517           3.93 .564 400000830
   84         3   0 0.28928             1.874     0.0042517           3.93 .564 400000840
   85         4   0 0.28928             1.874     0.0042517           3.93 .564 400000850
   86         5   0 0.28928             1.874     0.0042517           3.93 .564 400000860
   87         6   0 0.28928             1.874     0.0042517           3.93 .564 400000870
   88         1   7 0.21843             0.77791   0.0040931           2.82 .550 400000880
   89         2   8 0.21843             0.77791   0.0040931           2.82 .550 400000890
   90         3   9 0.21843             0.77791   0.0040931           2.82 .550 400000900
   91         4  10 0.21843             0.77791   0.0040931           2.82 .550 400000910
   92         5  11 0.21843             0.77791   0.0040931           2.82 .550 400000920
   93         6  12 0.21843             0.77791   0.0040931           2.82 .550 400000930
   94         7  13 0.11763             0.003551  0.098974            .115 1.25 400000940
   95         8  14 0.11763             0.003551  0.098974            .115 1.25 400000950
   96         9  15 0.11763             0.003551  0.098974            .115 1.25 400000960
   97        10  16 0.11763             0.003551  0.098974            .115 1.25 400000970
   98        11  17 0.44776             0.013077  0.308625            .663 1.25 400000980
   99        12  18 0.11763             0.003551  0.098974            .115 1.25 400000990
  100        17  22 0.11763             0.003551  0.098974            .115 1.25 400001000
  101        18  23 0.11763             0.003451  0.098974            .115 1.25 400001010
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

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                    1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

   102       14   19 0.23526             3.565410  0.197948            3.09 1.25 400001020
   103       19   24 0.11763             0.098974  0.003551            1.25 .115 400001030
   104       20   25 0.11763             0.098974  0.003551            1.25 .115 400001040
   105       21   26 0.11763             0.098974  0.003551            1.25 .115 400001050
   106       22   27 0.11763             0.098974  0.003551            1.25 .115 400001060
   107       23   28 0.11763             0.098974  0.003551            1.25 .115 400001070
   108       13   14 0.15763             0.011304  0.425691            .787 .968 400001080
   109       14   15 0.15763             0.011304  0.425691            .787 .968 400001090
   110       15   16 0.15763             0.011304  0.425691            .787 .968 400001100
   111       16   17 0.15763             0.011304  0.425691            .787 .968 400001110
   112       17   18 0.15763             0.011304  0.425691            .787 .968 400001120
   113       19   29 0.33012             3.798130  17.74063                      400001130
   114       20   21 0.33012             3.798130  17.74063                      400001140
   115       21   22 0.33012             3.798130  17.74063                      400001150
   116       22   23 0.33012             3.798130  17.74063                      400001160
   117        3 1 29 0.188               0.18000   0.54000             0.06 0.06 600001170
   118        5 2 29 0.188               0.18000   0.54000             0.06 0.06 600001180
   119        9 3 29 0.188               0.18000   0.54000             0.06 0.06 600001190
   120       11 4 29 0.188               0.18000   0.54000             0.06 0.06 600001200
   121       30   31 0.02000             0.0075    0.0075                        400001210
   122       30   32 0.009504            0.0048    0.0048                       1000001220
   123        5   30 0.0021571                                                   400001230
   124       11   30 0.0021571                                                   400001240
   125       29   30 0.000381                                                    400001250
   126     5 29 1 30 0.001170                                                    400001260
   127       14    0 0.11045                                                     100001270
   128       18    0 0.11045                                                     100001280
   129        5   30    1                                                         00001290
   130       11   30    1                                                         00001300
   131       29   30   -1                                                         00001310
   132     5 29 1 30   -1      0.00                                               00001320
   133       14    0    1                                                         00001330
   134       18    0    1                                                         00001340
   135     0.04                                                                   00001350
   136       30   31  .41                                                         00001360
   137       29   30    1    8 0.75                                             00001370
   138     5 29 1 30    1   10 0.0                                              00001380
   139       14   19    1    5  .082                                              00001390
   140       14   19    2    5  .48                                               00001391
   141       14   19    3    5  .194                                              00001400
   142       17   22    1    5  .054                                              00001410
   143       17   22    2    5  .48                                               00001411
   144       17   22    3    5 5.2                                                00001420
   145       18   23    1    5  .054                                              00001430
   146       18   23    2    5  .48                                               00001431
   147       18   23    3    5 5.2                                                00001440
   148       19   24    1    5  .037                                              00001450
   149       19   24    2    5 1.03                                               00001451
   150       19   24    3    5 1.03                                               00001460
   151       20   25    1    5  .037                                              00001470
   152       20   25    2    5 1.03                                               00001471
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                    1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

  153        20   25    3    5 1.03                                             00001480
  154        21   26    1    5  .037                                            00001490
  155        21   26    2    5 1.03                                             00001491
  156        21   26    3    5 1.030                                            00001500
  157        22   27    1    5  .037                                            00001510
  158        22   27    2    5 1.03                                             00001511
  159        22   27    3    5 1.03                                             00001520
  160        23   28    1    5  .037                                            00001530
  161        23   28    2    5 1.03                                             00001531
  162        23   28    3    5 1.03                                             00001540
  163         7   13    1    5  .045                                            00001550
  164         7   13    2    5 .682                                             00001551
  165         7   13    3    5 1.287                                            00001560
  166         8   14    1    5  .045                                            00001570
  167         8   14    2    5  .682                                            00001571
  168         8   14    3    5 1.287                                            00001580
  169         9   15    1    5  .045                                            00001590
  170         9   15    2    5  .682                                            00001591
  171         9   15    3    5 1.287                                            00001600
  172        10   16    1    5  .045                                            00001610
  173        10   16    2    5  .682                                            00001611
  174        10   16    3    5 1.287                                            00001620
  175        11   17    1    5  .045                                            00001630
  176        11   17    2    5  .682                                            00001631
  177        11   17    3    5 1.287                                            00001640
  178        12   18    1    5  .045                                            00001650
  179        12   18    2    5  .682                                            00001651
  180        12   18    3    5 1.287                                            00001660
  181         0.         .003                                                   00001661
  182          .75       .003                                                   00001662
  183          .751  1.                                                         00001663
  184         3.5    1.                                                         00001664
  185         3.51   0.                                                         00001665
  186         4.     0.                                                         00001666
  187         5.     0.                                                         00001667
  188         6.     0.                                                         00001668
  189         7.     0.                                                         00001669
  190        20.     0.                                                         00001670
  191        30   32                                                            00001675
  192         2    6    3       5.0       10.0                                  00001680
  193         2    4    6   24   25   26                                        00001690
  194         2    6    3       5.0        5.0                                  00001700
  195         8   10   12   14   16   18                                        00001710
  196         3    5    3     5.          10.                                   00001720
  197         4   13   16   21   26                                             00001730
  198         2    5    3     5.0          10.0                                 00001740
  199         3    6   29   30   31                                             00001750
  200         2    5    3     5.0          10.0                                 00001760
  201         9   11   29   30   31                                             00001770
  202         2    0    0    0    0    0    1    1    0                         00001780
  203         3    0    0    0    0    0    1    1    0                         00001790
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
                  1         2         3         4         5         6         7         8
CARD NO. 12345678901234567890123456789012345678901234567890123456789012345678901234567890

   204       5    0    0    0    0    0    1    1    0                           00001800
   205       9    0    0    0    0    0    1    1    0                           00001810
   206      10    0    0    0    0    0    1    1    0                           00001820
   207      11    0    0    0    0    0    1    1    0                           00001830
   208      14    1                                                              00001840
   209      19    1                                                              00001850
   210      21    1                                                              00001860
   211      15    1                                                              00001870
   212      20    1                                                              00001880
   213      25    1                                                              00001890
   214      17    1                                                              00001900
   215      22    1                                                              00001910
   216      27    1                                                              00001920
   217      29    1    0    0    0    0    1    1    0                           00001930
   218      30    1    0    0    0    0    1    1    0                           00001940
   219      31    1    0    0    0    0    1    1    0                           00001950
   220      32    1    0    0    0    0    1    1    0                           00001960
   221      46    1    1    1                                                    00001970
   222      49    1    1    1                                                    00001980
   223      50    1    1    1                                                    00001990
   224      54    1    1    1                                                    00002000
   225      55    1    1    1                                                    00002010
   226      56    1                                                              00002011
   227      57    1                                                              00002012
   228      46    1    1    1                                                    00002020
   229      49    1    1    1                                                    00002030
   230      50    1    1    1                                                    00002040
   231      54    1    1    1                                                    00002050
   232      55    1    1    1                                                    00002060
   233      56    1                                                              00002061
   234      57    1                                                              00002062
   235      23    1                                                              00002070
   236      24    1                                                              00002080
   237      25    1                                                              00002090
   238      26    1                                                              00002100
   239      27    1                                                              00002110
   240      28    1                                                              00002120
   241      29    1                                                              00002130
   242      30    1                                                              00002140
   243      31    1                                                              00002150
   244      32    1                                                              00002160
   245      33    1                                                              00002170
   246      34    1                                                              00002180
   247      35    1                                                              00002190
   248      36    1                                                              00002200
   249       2    0    1    1                                                    00002210
   250       3    0    1    1                                                    00002220
   251       4    0    1    1                                                    00002230
   252       5    0    1    1                                                    00002240
   253       6    0    1    1                                                    00002250
   254      32                                                                   00002260
```

ECHO OF THE INPUT DATA IN CARD IMAGE FORMAT

```
               1         2         3         4         5         6         7         8
CARD NO.  12345678901234567890123456789012345678901234567890123456789012345678901234567890
    ***   END                                                                     00002270
```

NASA ** NAVAJO SECTION DROP TEST SIMULATION
MODEL NUMBER 3 (9-1-78) PAN&CUSHION STIFF.PER DATA

PROGRAM SIZE AND CONTROL DATA

PROGRAM SIZE DATA

NUMBER OF:

MASSES	SPRINGS	BEAMS	KR TABLES	NON-ZERO HE OR IXY	MASS PENETR.	VOLUME CHANGE	DRI ELEMENTS	MTL TYPES	ACCEL. TABLES	NON-STANDARD MAX. DEFL.	NON-STANDARD MAX. FORCE	NON-ZERO PHI''	NON-STANDARD DAMPING	STIFFNESS MATRICES	NO. NODE PTS.
NM	NSP	NB	NLB	NHI	MVP	NVCH	NDRI	NMTL	NACC	NVBM	NFBM	NPH	ND	NKM	NNP
32	10	57	44	0	0	0	1	0	0	0	0	0	1	0	6

NSC= 0 NIC= 1 NTOL1= 10% NTOL2= 50% NTOL3= 100%

PROGRAM DATA MANAGEMENT CONTROL DATA

RESTART: TITLE -
CASE - 0
TIME - 0

SAVE: TITLE -
CASE - 0
TIMES - 0 0 0 0 0

VARIABLE INTEGRATION CONTROL DATA

VAR. INT. FLAG = 0 EL = 0.0 EU = 0.0 LOWER RATIO = 0.0 UPPER RATIO = 0.0

PROGRAM CONTROL DATA

PRINT INTERVAL/ INTEGRATION INTERVAL	INTEGRATION INTERVAL	MAX. TIME	PLOW FORCE STARTING TIME	FILTER CUTOFF FREQUENCY	CASE TYPE INDICATOR
DP/DT	DT	TMAX	PLOWT	FCUT	RUNMOD
100	0.000010	0.054000	0.0	85.000	1.000

TIME HISTORY PRINT CONTROL CARDS

STRAIN FORCES	TOTAL FORCES	BEAM DEFLECTIONS	EXT.SPRING DATA	ENERGY DATA	STRESS DATA	ACCEL DATA
0	0	0	0	0	0	0

NO.OF MASS POSITION PLOTS EACH TIME= 5 PLOT PRINT FACTOR = 18

PLANE I.D.	NO. OF POINTS
2	6
2	6
3	5
2	5
2	5

VEHICLE INITIAL CONDITIONS

VEHICLE TRANSLATIONAL VELOCITIES IN GROUND AXES (IN/SEC)
VEHICLE ROTATIONAL VELOCITIES IN VEHICLE AXES (RAD/SEC)
EULER ANGLES OF VEHICLE RELATIVE TO GROUND (RADIANS)

XGDOT	YGDOT	ZGDOT
P'	Q'	R'
PHI'	THETA'	PSI'
0.0	0.0	3.300000 02
0.0	0.0	0.0
0.0	1.310000-02	0.0

GENERALIZED SURFACE DATA

BETA = 0.0 DEGREES
XCIN = 0.0
_GIN = 0.0

MASS DATA

	WEIGHTS	MASS COORDINATES F.S.,B.L.,W.L.			MASS MOMENTS OF INERTIA (LB-IN-SEC**2)			
I	W	X''	Y''	Z''	IX	IY	IZ	I
1	1.370000 00	1.350000 02	6.000000 00	-1.600000 01	1.183000-01	8.312000-02	4.999000-02	1
2	4.380000 00	1.400000 02	6.000000 00	-1.600000 01	3.782200-01	3.281100-01	2.222000-01	2
3	1.630000 01	1.510000 02	6.000000 00	-1.600000 01	4.344000 00	4.400000 00	5.000000-01	3
4	6.300000 00	1.630000 02	6.000000 00	-1.600000 01	5.440100-01	5.291000-01	3.767400-01	4
5	4.930000 00	1.740000 02	6.000000 00	-1.600000 01	4.257100-01	3.714300-01	2.522700-01	5
6	1.910000 00	1.810000 02	6.000000 00	-1.600000 01	1.654000-01	1.261000-01	8.000000-02	6
7	1.750000 00	1.350000 02	2.000000 01	-1.600000 01	4.275000-01	3.323000-01	1.277200-01	7
8	5.580000 00	1.400000 02	2.000000 01	-1.600000 01	1.350400 00	1.221500 00	7.705000-01	8
9	1.802000 01	1.510000 02	2.000000 01	-1.600000 01	5.720000 00	5.680000 00	1.091000 00	9
10	8.020000 00	1.630000 02	2.000000 01	-1.600000 01	1.942100 00	1.902330 00	9.616100-01	10
11	6.280000 00	1.740000 02	2.000000 01	-1.600000 01	1.540000 00	1.380000 00	6.440300-01	11
12	2.440000 00	1.810000 02	2.000000 01	-1.600000 01	5.970000-01	4.899000-01	2.038500-01	12
13	4.100000-01	1.350000 02	2.800000 01	9.000000 00	5.960000-02	6.130000-02	2.730000-03	13
14	2.400000 00	1.400000 02	2.800000 01	9.000000 00	3.079000-01	3.518000-01	5.038000-02	14
15	1.870000 00	1.510000 02	2.800000 01	9.000000 00	2.754200-01	3.266000-01	5.620000-02	15
16	1.870000 00	1.630000 02	2.800000 01	9.000000 00	2.754200-01	3.266000-01	5.620000-02	16
17	2.700000 00	1.740000 02	2.800000 01	9.000000 00	3.463900-01	3.969600-01	4.185300-01	17
18	1.050000 00	1.810000 02	2.800000 01	9.000000 00	1.347100-01	1.444000-01	1.253000-02	18
19	2.050000 00	1.400000 02	2.800000 01	3.100000 01	5.956000-01	2.792000-01	4.770000-01	19
20	2.230000 00	1.520000 02	2.800000 01	3.100000 01	3.627600-01	1.797000-01	3.111300-01	20
21	2.230000 00	1.630000 02	2.800000 01	3.100000 01	3.627600-01	1.797000-01	3.111300-01	21
22	2.810000 00	1.740000 02	2.800000 01	3.100000 01	8.167000-01	3.860000-01	6.564000-01	22
23	1.100000 00	1.810000 02	2.800000 01	3.100000 01	3.185000-01	1.296000-01	2.350000-01	23
24	2.800000 00	1.400000 02	0.0	4.700000 01	4.780000-01	5.880000-02	5.289200-01	24
25	4.020000 00	1.510000 02	0.0	4.700000 01	6.858500-01	1.208400-01	7.958400-01	25
26	4.020000 00	1.630000 02	0.0	4.700000 01	6.858500-01	1.208400-01	7.958400-01	26
27	3.150000 00	1.740000 02	0.0	4.700000 01	5.374200-01	6.704000-02	5.963900-01	27
28	1.230000 00	1.810000 02	0.0	4.700000 01	2.098500-01	1.467000-02	2.211900-01	28
29	2.050000 01	1.660000 02	1.300000 01	-1.700000 00	5.950000 00	6.606200 00	3.152000 00	29
30	7.286000 01	1.660000 02	1.300000 01	5.800000 00	1.395110 01	1.477420 01	1.683410 01	30
31	7.286000 01	1.660000 02	1.300000 01	2.089000 01	1.131160 01	1.079890 01	6.531800 00	31
32	7.286000 01	1.660000 02	1.300000 01	2.089000 01	1.131160 01	1.079890 01	6.531800 00	32

NODE POINT DATA

MASS I	N.P. M	NODE POINT COORDINATES F.S.,B.L.,W.L. X''	Y''	Z''
29	1	1.51000D 02	6.00000D 00	-1.70000D 00
29	2	1.74000D 02	6.00000D 00	-1.70000D 00
29	3	1.51000D 02	2.00000D 01	-1.70000D 00
29	4	1.74000D 02	2.00000D 01	-1.70000D 00
29	5	1.66000D 02	1.30000D 01	-1.70000D 00
30	1	1.66000D 02	1.30000D 01	5.80000D 00

EXTERNAL SPRING DATA

SPRING			FREE LENGTH	FRICTION COEFFICIENT	BOTTOMING SPRING	PLOWING FORCE	GROUND FLEXIBILITY
I	K	M	LBAR(IKM)	MU(IKM)	KE(IKM)	FORCE(IKM)	GFLEX(IKM)
2	3	0	8.00000D 00	0.0	5.00000D 04	0.0	0.0
3	3	0	8.00000D 00	0.0	5.00000D 04	0.0	0.0
4	3	0	8.00000D 00	0.0	5.00000D 04	0.0	0.0
5	3	0	8.00000D 00	0.0	5.00000D 04	0.0	0.0
6	3	0	8.00000D 00	0.0	5.00000D 04	0.0	0.0
8	3	0	3.30000D 00	0.0	2.00000D 04	0.0	0.0
9	3	0	3.30000D 00	0.0	2.00000D 04	0.0	0.0
10	3	0	3.30000D 00	0.0	2.00000D 04	0.0	0.0
11	3	0	3.30000D 00	0.0	2.00000D 04	0.0	0.0
12	3	0	3.30000D 00	0.0	2.00000D 04	0.0	0.0

SPRING			DEFLECTION COORDINATES				SPRING AXIAL FORCES	
I	K	M	SI(IKM)	SA(IKM)	SB(IKM)	SF(IKM)	FSPOI(IKM)	FSPOF(IKM)
2	3	0	1.00000D-01	7.00000D-01	1.00000D 00	2.50000D 00	2.29000D 03	2.29000D 03
3	3	0	1.00000D-01	7.00000D-01	1.00000D 00	2.50000D 00	2.65000D 03	2.65000D 03
4	3	0	1.00000D-01	7.00000D-01	1.00000D 00	2.50000D 00	2.65000D 03	2.65000D 03
5	3	0	1.00000D-01	7.00000D-01	1.00000D 00	2.50000D 00	2.41000D 03	2.41000D 03
6	3	0	1.00000D-01	7.00000D-01	1.00000D 00	2.50000D 00	1.76000D 03	1.76000D 03
8	3	0	4.50000D-02	5.50000D-02	1.50000D-01	1.10000D 00	1.38000D 03	1.38000D 03
9	3	0	4.50000D-02	5.50000D-02	1.50000D-01	1.10000D 00	1.38000D 03	1.38000D 03
10	3	0	4.50000D-02	5.50000D-02	1.50000D-01	1.10000D 00	1.38000D 03	1.38000D 03
11	3	0	4.50000D-02	5.50000D-02	1.50000D-01	1.10000D 00	1.38000D 03	1.38000D 03
12	3	0	4.50000D-02	5.50000D-02	1.50000D-01	1.10000D 00	1.38000D 03	1.38000D 03

MATERIAL PROPERTIES

MATERIAL NO.	MODULUS OF ELASTICITY	MODULUS OF RIGIDITY	TENSION STRESS	COMPRESS. STRESS	SHEAR STRESS
1	3.0000D 07	1.1000D 07	75000.	75000.	37500.
2	3.0000D 07	1.1000D 07	205000.	205000.	80000.
3	2.8000D 07	1.2500D 07	70000.	46000.	36000.
4	1.0500D 07	4.0000D 06	47000.	39000.	22000.
5	1.0000D 07	3.8000D 06	35000.	34000.	17000.
6	1.0000D 07	3.8000D 06	16000.	16000.	17000.
7	1.0000D 06	3.0000D 05	16000.	16000.	17000.
8	1.0000D 06	0.0	16000.	16000.	17000.
9	1.0000D 06	3.0000D 05	16000.	16000.	17000.

10 1.00000 06 3.00000 05 16000. 16000. 17000.

INTERNAL BEAM DATA

BEAM					AREA	MOMENTS OF INERTIA			DISTANCES FROM NEUTRAL AXIS TO EXTREME FIBRES ZBIJ AXIS	YBIJ AXIS	TORSION PARAMETER	LENGTH	DAMPING RATIO	MTL	P-CODES Y I	Z I	Y J	Z J	BEAM				
IJ	I	J	M	N	A	IYY	IZZ	JX	Z1	Z2	XIQ	XLB	CBAR	MC					IJ	I	J	M	N
1	1	2	0	0	6.157D-01	4.182D 00	6.052D-02	4.243D 00	5.780D 00	6.670D-01	0.0	5.000D 00	4.000D-02	4	0	0	0	0	1	1	2	0	0
2	2	3	0	0	6.157D-01	4.182D 00	6.052D-02	4.243D 00	5.780D 00	6.670D-01	0.0	1.100D 01	4.000D-02	4	0	0	0	0	2	2	3	0	0
3	3	4	0	0	6.157D-01	4.182D 00	6.052D-02	4.243D 00	5.780D 00	6.670D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	3	3	4	0	0
4	4	5	0	0	6.157D-01	4.182D 00	6.052D-02	4.243D 00	5.780D 00	6.670D-01	0.0	1.100D 01	4.000D-02	4	0	0	0	0	4	4	5	0	0
5	5	6	0	0	6.157D-01	4.182D 00	6.052D-02	4.243D 00	5.780D 00	6.670D-01	0.0	7.000D 00	4.000D-02	4	0	0	0	0	5	5	6	0	0
6	7	8	0	0	1.280D-01	3.418D-01	4.267D-02	3.844D-01	1.650D 00	1.000D 00	0.0	5.000D 00	4.000D-02	4	0	0	0	0	6	7	8	0	0
7	8	9	0	0	1.280D-01	3.418D-01	4.267D-02	3.844D-01	1.650D 00	1.000D 00	0.0	1.100D 01	4.000D-02	4	0	0	0	0	7	8	9	0	0
8	9	10	0	0	1.280D-01	3.418D-01	4.267D-02	3.844D-01	1.650D 00	1.000D 00	0.0	1.200D 01	4.000D-02	4	0	0	0	0	8	9	10	0	0
9	10	11	0	0	1.280D-01	3.418D-01	4.267D-02	3.844D-01	1.650D 00	1.000D 00	0.0	1.100D 01	4.000D-02	4	0	0	0	0	9	10	11	0	0
10	11	12	0	0	1.280D-01	3.418D-01	4.267D-02	3.844D-01	1.650D 00	1.000D 00	0.0	7.000D 00	4.000D-02	4	0	0	0	0	10	11	12	0	0
11	1	0	0	0	2.893D-01	1.874D 00	4.252D-03	1.878D 00	3.930D 00	5.640D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	11	1	0	0	0
12	2	0	0	0	2.893D-01	1.874D 00	4.252D-03	1.878D 00	3.930D 00	5.640D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	12	2	0	0	0
13	3	0	0	0	2.893D-01	1.874D 00	4.252D-03	1.878D 00	3.930D 00	5.640D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	13	3	0	0	0
14	4	0	0	0	2.893D-01	1.874D 00	4.252D-03	1.878D 00	3.930D 00	5.640D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	14	4	0	0	0
15	5	0	0	0	2.893D-01	1.874D 00	4.252D-03	1.878D 00	3.930D 00	5.640D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	15	5	0	0	0
16	6	0	0	0	2.893D-01	1.874D 00	4.252D-03	1.878D 00	3.930D 00	5.640D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	16	6	0	0	0
17	1	7	0	0	2.184D-01	7.779D-01	4.093D-03	7.820D-01	2.820D 00	5.500D-01	0.0	1.400D 01	4.000D-02	4	0	0	0	0	17	1	7	0	0
18	2	8	0	0	2.184D-01	7.779D-01	4.093D-03	7.820D-01	2.820D 00	5.500D-01	0.0	1.400D 01	4.000D-02	4	0	0	0	0	18	2	8	0	0
19	3	9	0	0	2.184D-01	7.779D-01	4.093D-03	7.820D-01	2.820D 00	5.500D-01	0.0	1.400D 01	4.000D-02	4	0	0	0	0	19	3	9	0	0
20	4	10	0	0	2.184D-01	7.779D-01	4.093D-03	7.820D-01	2.820D 00	5.500D-01	0.0	1.400D 01	4.000D-02	4	0	0	0	0	20	4	10	0	0
21	5	11	0	0	2.184D-01	7.779D-01	4.093D-03	7.820D-01	2.820D 00	5.500D-01	0.0	1.400D 01	4.000D-02	4	0	0	0	0	21	5	11	0	0
22	6	12	0	0	2.184D-01	7.779D-01	4.093D-03	7.820D-01	2.820D 00	5.500D-01	0.0	1.400D 01	4.000D-02	4	0	0	0	0	22	6	12	0	0
23	7	13	0	0	1.176D-01	3.551D-03	9.897D-02	1.025D-01	1.150D-01	1.250D 00	0.0	2.625D 01	4.000D-02	4	0	0	0	0	23	7	13	0	0
24	8	14	0	0	1.176D-01	3.551D-03	9.897D-02	1.025D-01	1.150D-01	1.250D 00	0.0	2.625D 01	4.000D-02	4	0	0	0	0	24	8	14	0	0
25	9	15	0	0	1.176D-01	3.551D-03	9.897D-02	1.025D-01	1.150D-01	1.250D 00	0.0	2.625D 01	4.000D-02	4	0	0	0	0	25	9	15	0	0
26	10	16	0	0	1.176D-01	3.551D-03	9.897D-02	1.025D-01	1.150D-01	1.250D 00	0.0	2.625D 01	4.000D-02	4	0	0	0	0	26	10	16	0	0
27	11	17	0	0	4.478D-01	1.308D-02	3.086D-01	3.217D-01	6.630D-01	1.250D 00	0.0	2.625D 01	4.000D-02	4	0	0	0	0	27	11	17	0	0
28	12	18	0	0	1.176D-01	3.551D-03	9.897D-02	1.025D-01	1.150D-01	1.250D 00	0.0	2.625D 01	4.000D-02	4	0	0	0	0	28	12	18	0	0
29	17	22	0	0	1.176D-01	3.551D-03	9.897D-02	1.025D-01	1.150D-01	1.250D 00	0.0	2.200D 01	4.000D-02	4	0	0	0	0	29	17	22	0	0
30	18	23	0	0	1.176D-01	3.551D-03	9.897D-02	1.025D-01	1.150D-01	1.250D 00	0.0	2.200D 01	4.000D-02	4	0	0	0	0	30	18	23	0	0
31	14	19	0	0	2.353D-01	3.565D 00	1.979D-01	3.763D 00	3.090D 00	1.250D 00	0.0	2.200D 01	4.000D-02	4	0	0	0	0	31	14	19	0	0
32	19	24	0	0	1.176D-01	9.897D-02	3.551D-03	1.025D-01	1.250D 00	1.150D-01	0.0	3.225D 01	4.000D-02	4	0	0	0	0	32	19	24	0	0
33	20	25	0	0	1.176D-01	9.897D-02	3.551D-03	1.025D-01	1.250D 00	1.150D-01	0.0	3.225D 01	4.000D-02	4	0	0	0	0	33	20	25	0	0
34	21	26	0	0	1.176D-01	9.897D-02	3.551D-03	1.025D-01	1.250D 00	1.150D-01	0.0	3.225D 01	4.000D-02	4	0	0	0	0	34	21	26	0	0
35	22	27	0	0	1.176D-01	9.897D-02	3.551D-03	1.025D-01	1.250D 00	1.150D-01	0.0	3.225D 01	4.000D-02	4	0	0	0	0	35	22	27	0	0
36	23	28	0	0	1.176D-01	9.897D-02	3.551D-03	1.025D-01	1.250D 00	1.150D-01	0.0	3.225D 01	4.000D-02	4	0	0	0	0	36	23	28	0	0
37	13	14	0	0	1.176D-01	1.130D-02	4.257D-01	4.370D-01	7.870D-01	9.680D-01	0.0	5.000D 00	4.000D-02	4	0	0	0	0	37	13	14	0	0
38	14	15	0	0	1.176D-01	1.130D-02	4.257D-01	4.370D-01	7.870D-01	9.680D-01	0.0	1.100D 01	4.000D-02	4	0	0	0	0	38	14	15	0	0
39	15	16	0	0	1.176D-01	1.130D-02	4.257D-01	4.370D-01	7.870D-01	9.680D-01	0.0	1.200D 01	4.000D-02	4	0	0	0	0	39	15	16	0	0
40	16	17	0	0	1.176D-01	1.130D-02	4.257D-01	4.370D-01	7.870D-01	9.680D-01	0.0	1.100D 01	4.000D-02	4	0	0	0	0	40	16	17	0	0
41	17	18	0	0	1.576D-01	1.130D-02	4.257D-01	4.370D-01	7.870D-01	9.680D-01	0.0	7.000D 00	4.000D-02	4	0	0	0	0	41	17	18	0	0
42	19	20	0	0	3.301D-01	3.798D 00	1.774D 01	2.154D 01	0.0	0.0	0.0	1.100D 01	4.000D-02	4	0	0	0	0	42	19	20	0	0
43	20	21	0	0	3.301D-01	3.798D 00	1.774D 01	2.154D 01	0.0	0.0	0.0	1.200D 01	4.000D-02	4	0	0	0	0	43	20	21	0	0
44	21	22	0	0	3.301D-01	3.798D 00	1.774D 01	2.154D 01	0.0	0.0	0.0	1.100D 01	4.000D-02	4	0	0	0	0	44	21	22	0	0
45	22	23	0	0	3.301D-01	3.798D 00	1.774D 01	2.154D 01	0.0	0.0	0.0	7.000D 00	4.000D-02	4	0	0	0	0	45	22	23	0	0
46	3	29	0	1	1.880D-01	1.800D-01	5.400D-01	7.200D-01	6.000D-02	6.000D-02	0.0	1.430D 01	4.000D-02	6	0	0	0	0	46	3	29	0	1
47	5	29	0	2	1.880D-01	1.800D-01	5.400D-01	7.200D-01	6.000D-02	6.000D-02	0.0	1.430D 01	4.000D-02	6	0	0	0	0	47	5	29	0	2
48	9	29	0	3	1.880D-01	1.800D-01	5.400D-01	7.200D-01	6.000D-02	6.000D-02	0.0	1.430D 01	4.000D-02	6	0	0	0	0	48	9	29	0	3
49	11	29	0	4	1.880D-01	1.800D-01	5.400D-01	7.200D-01	6.000D-02	6.000D-02	0.0	1.430D 01	4.000D-02	6	0	0	0	0	49	11	29	0	4

```
50 30 31  0  0 2.000D-02 7.500D-03 7.500D-03 1.500D-02 0.0   0.0   0.0   1.509D 01 4.100D-01 4 0 0 0 0 50 30 31  0  0
51 30 32  0  0 7.197D-03 4.800D-03 4.800D-03 9.600D-03 0.0   0.0   0.0   1.509D 01 3.111D-0110 0 0 0 0 51 30 32  0  0
52  5 30  0  0 2.157D-03 0.0       0.0       0.0       0.0   0.0   0.0   2.425D 01 4.000D-02 4 0 0 0 0 52  5 30  0  0
53 11 30  0  0 2.157D-03 0.0       0.0       0.0       0.0   0.0   0.0   2.425D 01 4.000D-02 4 0 0 0 0 53 11 30  0  0
54 29 30  0  0 3.810D-04 0.0       0.0       0.0       0.0   0.0   0.0   7.500D 00 4.000D-02 4 0 0 0 0 54 29 30  0  0
55 29 30  5  1 1.170D-03 0.0       0.0       0.0       0.0   0.0   0.0   7.500D 00 4.000D-02 4 0 0 0 0 55 29 30  5  1
56 14  0  0  0 1.105D-01 0.0       0.0       0.0       0.0   0.0   0.0   5.600D 01 4.000D-02 1 0 0 0 0 56 14  0  0  0
57 18  0  0  0 1.105D-01 0.0       0.0       0.0       0.0   0.0   0.0   5.600D 01 4.000D-02 1 0 0 0 0 57 18  0  0  0
```

UNSYMMETRICAL BEAM DATA

BEAM					TENSION-COMPRESSION FLAG	DEADBAND
IJ	I	J	M	N	IJUB	DB
52	5	30	0	0	1	0.0
53	11	30	0	0	1	0.0
54	29	30	0	0	-1	0.0
55	29	30	5	1	-1	0.0
56	14	0	0	0	1	0.0
57	18	0	0	0	1	0.0

NONLINEAR BEAM DATA

BEAM					DIRECTION	STANDARD TABLE NO.	LINEAR DEFLECTION	BOTTOMING DEFLECTION
IJ	I	J	M	N	L	NP	LDP	LDP1
54	29	30	0	0	1	8	7.50000E-01	0.0
55	29	30	5	1	1	10	0.0	0.0
31	14	19	0	0	1	5	8.20000E-02	0.0
31	14	19	0	0	2	5	4.80000E-01	0.0
31	14	19	0	0	3	5	1.94000E-01	0.0
29	17	22	0	0	1	5	5.40000E-02	0.0
29	17	22	0	0	2	5	4.80000E-01	0.0
29	17	22	0	0	3	5	5.20000E 00	0.0
30	18	23	0	0	1	5	5.40000E-02	0.0
30	18	23	0	0	2	5	4.80000E-01	0.0
30	18	23	0	0	3	5	5.20000E 00	0.0
32	19	24	0	0	1	5	3.70000E-02	0.0
32	19	24	0	0	2	5	1.03000E 00	0.0
32	19	24	0	0	3	5	1.03000E 00	0.0
33	20	25	0	0	1	5	3.70000E-02	0.0
33	20	25	0	0	2	5	1.03000E 00	0.0
33	20	25	0	0	3	5	1.03000E 00	0.0
34	21	26	0	0	1	5	3.70000E-02	0.0
34	21	26	0	0	2	5	1.03000E 00	0.0
34	21	26	0	0	3	5	1.03000E 00	0.0
35	22	27	0	0	1	5	3.70000E-02	0.0
35	22	27	0	0	2	5	1.03000E 00	0.0
35	22	27	0	0	3	5	1.03000E 00	0.0
36	23	28	0	0	1	5	3.70000E-02	0.0
36	23	28	0	0	2	5	1.03000E 00	0.0
36	23	28	0	0	3	5	1.03000E 00	0.0
23	7	13	0	0	1	5	4.50000E-02	0.0

23	7	13	0	0	2	5	6.82000E-01	0.0
23	7	13	0	0	3	5	1.28700E 00	0.0
24	8	14	0	0	1	5	4.50000E-02	0.0
24	8	14	0	0	2	5	6.82000E-01	0.0
24	8	14	0	0	3	5	1.28700E 00	0.0
25	9	15	0	0	1	5	4.50000E-02	0.0
25	9	15	0	0	2	5	6.82000E-01	0.0
25	9	15	0	0	3	5	1.28700E 00	0.0
26	10	16	0	0	1	5	4.50000E-02	0.0
26	10	16	0	0	2	5	6.82000E-01	0.0
26	10	16	0	0	3	5	1.28700E 00	0.0
27	11	17	0	0	1	5	4.50000E-02	0.0
27	11	17	0	0	2	5	6.82000E-01	0.0
27	11	17	0	0	3	5	1.28700E 00	0.0
28	12	18	0	0	1	5	4.50000E-02	0.0
28	12	18	0	0	2	5	6.82000E-01	0.0
28	12	18	0	0	3	5	1.28700E 00	0.0

KR TABLE FOR I,J,M,N,L = 29 30 0 0 1

1	0.0	1.00000E 00
2	7.50000E-01	1.00000E 00
3	7.50750E-01	-1.00000E 00
4	1.50000E 00	-1.00000E 00
5	1.50075E 00	0.0
6	7.50000E 00	0.0
7	1.12500E 01	0.0
8	1.50000E 01	0.0

KR TABLE FOR I,J,M,N,L = 29 30 5 1 1

1	0.0	3.00000E-03
2	7.50000E-01	3.00000E-03
3	7.51000E-01	1.00000E 00
4	3.50000E 00	1.00000E 00
5	3.51000E 00	0.0
6	4.00000E 00	0.0
7	5.00000E 00	0.0
8	6.00000E 00	0.0
9	7.00000E 00	0.0
10	2.00000E 01	0.0

KR TABLE FOR I,J,M,N,L = 14 19 0 0 1

1	0.0	1.00000E 00
2	8.20000E-02	1.00000E 00
3	8.20819E-02	0.0
4	8.20000E-01	0.0
5	1.64000E 00	0.0

KR TABLE FOR I,J,M,N,L = 14 19 0 0 2

1	0.0	1.00000E 00
2	4.80000E-01	1.00000E 00
3	4.80480E-01	0.0
4	4.80000E 00	0.0
5	9.60000E 00	0.0

KR TABLE FOR I,J,M,N,L = 14 19 0 0 3

1	0.0	1.00000E 00
2	1.94000E-01	1.00000E 00
3	1.94194E-01	0.0
4	1.94000E 00	0.0
5	3.[illegible]8000E 00	0.0

```
KR TABLE FOR I,J,M,N,L =   17   22    0    0    1
  1     0.0          1.00000E 00
  2     5.40000E-02  1.00000E 00
  3     5.40540E-02  0.0
  4     5.40000E-01  0.0
  5     1.08000E 00  0.0

KR TABLE FOR I,J,M,N,L =   17   22    0    0    2
  1     0.0          1.00000E 00
  2     4.80000E-01  1.00000E 00
  3     4.80480E-01  0.0
  4     4.80000E 00  0.0
  5     9.60000E 00  0.0

KR TABLE FOR I,J,M,N,L =   17   22    0    0    3
  1     0.0          1.00000E 00
  2     5.20000E 00  1.00000E 00
  3     5.20520E 00  0.0
  4     5.20000E 01  0.0
  5     1.04000E 02  0.0

KR TABLE FOR I,J,M,N,L =   18   23    0    0    1
  1     0.0          1.00000E 00
  2     5.40000E-02  1.00000E 00
  3     5.40540E-02  0.0
  4     5.40000E-01  0.0
  5     1.08000E 00  0.0

KR TABLE FOR I,J,M,N,L =   18   23    0    0    2
  1     0.0          1.00000E 00
  2     4.80000E-01  1.00000E 00
  3     4.80480E-01  0.0
  4     4.80000E 00  0.0
  5     9.60000E 00  0.0

KR TABLE FOR I,J,M,N,L =   18   23    0    0    3
  1     0.0          1.00000E 00
  2     5.20000E 00  1.00000E 00
  3     5.20520E 00  0.0
  4     5.20000E 01  0.0
  5     1.04000E 02  0.0

KR TABLE FOR I,J,M,N,L =   19   24    0    0    1
  1     0.0          1.00000E 00
  2     3.70000E-02  1.00000E 00
  3     3.70370E-02  0.0
  4     3.70000E-01  0.0
  5     7.40000E-01  0.0

KR TABLE FOR I,J,M,N,L =   19   24    0    0    2
  1     0.0          1.00000E 00
  2     1.03000E 00  1.00000E 00
  3     1.03103E 00  0.0
  4     1.03000E 01  0.0
  5     2.06000E 01  0.0

KR TABLE FOR I,J,M,N,L =   19   24    0    0    3
  1     0.0          1.00000E 00
  2     1.03000E 00  1.00000E 00
  3     1.03103E 00  0.0
```

```
   4    1.03000E 01    0.0
   5    2.06000E 01    0.0

 KR TABLE FOR I,J,M,N,L =   20   25    0    0    1
   1    0.0            1.00000E 00
   2    3.70000E-02    1.00000E 00
   3    3.70370E-02    0.0
   4    3.70000E-01    0.0
   5    7.40000E-01    0.0

 KR TABLE FOR I,J,M,N,L =   20   25    0    0    2
   1    0.0            1.00000E 00
   2    1.03000E 00    1.00000E 00
   3    1.03103E 00    0.0
   4    1.03000E 01    0.0
   5    2.06000E 01    0.0

 KR TABLE FOR I,J,M,N,L =   20   25    0    0    3
   1    0.0            1.00000E 00
   2    1.03000E 00    1.00000E 00
   3    1.03103E 00    0.0
   4    1.03000E 01    0.0
   5    2.06000E 01    0.0

 KR TABLE FOR I,J,M,N,L =   21   26    0    0    1
   1    0.0            1.00000E 00
   2    3.70000E-02    1.00000E 00
   3    3.70370E-02    0.0
   4    3.70000E-01    0.0
   5    7.40000E-01    0.0

 KR TABLE FOR I,J,M,N,L =   21   26    0    0    2
   1    0.0            1.00000E 00
   2    1.03000E 00    1.00000E 00
   3    1.03103E 00    0.0
   4    1.03000E 01    0.0
   5    2.06000E 01    0.0

 KR TABLE FOR I,J,M,N,L =   21   26    0    0    3
   1    0.0            1.00000E 00
   2    1.03000E 00    1.00000E 00
   3    1.03103E 00    0.0
   4    1.03000E 01    0.0
   5    2.06000E 01    0.0

 KR TABLE FOR I,J,M,N,L =   22   27    0    0    1
   1    0.0            1.00000E 00
   2    3.70000E-02    1.00000E 00
   3    3.70370E-02    0.0
   4    3.70000E-01    0.0
   5    7.40000E-01    0.0

 KR TABLE FOR I,J,M,N,L =   22   27    0    0    2
   1    0.0            1.00000E 00
   2    1.03000E 00    1.00000E 00
   3    1.03103E 00    0.0
   4    1.03000E 01    0.0
   5    2.06000E 01    0.0

 KR TABLE FOR I,J,M,N,L =   22   27    0    0    3
```

```
   1      0.0            1.00000E 00
   2      1.03000E 00    1.00000E 00
   3      1.03103E 00    0.0
   4      1.03000E 01    0.0
   5      2.06000E 01    0.0

 KR TABLE FOR I,J,M,N,L =    23   28    0    0    1
   1      0.0            1.00000E 00
   2      3.70000E-02    1.00000E 00
   3      3.70370E-02    0.0
   4      3.70000E-01    0.0
   5      7.40000E-01    0.0

 KR TABLE FOR I,J,M,N,L =    23   28    0    0    2
   1      0.0            1.00000E 00
   2      1.03000E 00    1.00000E 00
   3      1.03103E 00    0.0
   4      1.03000E 01    0.0
   5      2.06000E 01    0.0

 KR TABLE FOR I,J,M,N,L =    23   28    0    0    3
   1      0.0            1.00000E 00
   2      1.03000E 00    1.00000E 00
   3      1.03103E 00    0.0
   4      1.03000E 01    0.0
   5      2.06000E 01    0.0

 KR TABLE FOR I,J,M,N,L =     7   13    0    0    1
   1      0.0            1.00000E 00
   2      4.50000E-02    1.00000E 00
   3      4.50450E-02    0.0
   4      4.50000E-01    0.0
   5      9.00000E-01    0.0

 KR TABLE FOR I,J,M,N,L =     7   13    0    0    2
   1      0.0            1.00000E 00
   2      6.82000E-01    1.00000E 00
   3      6.82682E-01    0.0
   4      6.82000E 00    0.0
   5      1.36400E 01    0.0

 KR TABLE FOR I,J,M,N,L =     7   13    0    0    3
   1      0.0            1.00000E 00
   2      1.28700E 00    1.00000E 00
   3      1.28829E 00    0.0
   4      1.28700E 01    0.0
   5      2.57400E 01    0.0

 KR TABLE FOR I,J,M,N,L =     8   14    0    0    1
   1      0.0            1.00000E 00
   2      4.50000E-02    1.00000E 00
   3      4.50450E-02    0.0
   4      4.50000E-01    0.0
   5      9.00000E-01    0.0

 KR TABLE FOR I,J,M,N,L =     8   14    0    0    2
   1      0.0            1.00000E 00
   2      6.82000E-01    1.00000E 00
   3      6.82682E-01    0.0
   4      6.82000E 00    0.0
```

```
   5   1.36400E 01    0.0

  KR TABLE FOR I,J,M,N,L =    8   14     0     0     3
   1   0.0            1.00000E 00
   2   1.28700E 00    1.00000E 00
   3   1.28829E 00    0.0
   4   1.28700E 01    0.0
   5   2.57400E 01    0.0

  KR TABLE FOR I,J,M,N,L =    9   15     0     0     1
   1   0.0            1.00000E 00
   2   4.50000E-02    1.00000E 00
   3   4.50450E-02    0.0
   4   4.50000E-01    0.0
   5   9.00000E-01    0.0

  KR TABLE FOR I,J,M,N,L =    9   15     0     0     2
   1   0.0            1.00000E 00
   2   6.82000E-01    1.00000E 00
   3   6.82682E-01    0.0
   4   6.82000E 00    0.0
   5   1.36400E 01    0.0

  KR TABLE FOR I,J,M,N,L =    9   15     0     0     3
   1   0.0            1.00000E 00
   2   1.28700E 00    1.00000E 00
   3   1.28829E 00    0.0
   4   1.28700E 01    0.0
   5   2.57400E 01    0.0

  KR TABLE FOR I,J,M,N,L =   10   16     0     0     1
   1   0.0            1.00000E 00
   2   4.50000E-02    1.00000E 00
   3   4.50450E-02    0.0
   4   4.50000E-01    0.0
   5   9.00000E-01    0.0

  KR TABLE FOR I,J,M,N,L =   10   16     0     0     2
   1   0.0            1.00000E 00
   2   6.82000E-01    1.00000E 00
   3   6.82682E-01    0.0
   4   6.82000E 00    0.0
   5   1.36400E 01    0.0

  KR TABLE FOR I,J,M N,L =   10   16     0     0     3
   1   0.0            1.00000E 00
   2   1.28700E 00    1.00000E 00
   3   1.28829E 00    0.0
   4   1.28700E 01    0.0
   5   2.57400E 01    0.0

  KR TABLE FOR I,J,M,N,L =   11   17     0     0     1
   1   0.0            1.00000E 00
   2   4.50000E-02    1.00000E 00
   3   4.50450E-02    0.0
   4   4.50000E-01    0.0
   5   9.00000E-01    0.0

  KR TABLE FOR I,J,M,N,L =   11   17     0     0     2
   1   0.0            1.00000E 00
```

```
   2    6.82000E-01    1.00000E 00
   3    6.82682E-01    0.0
   4    6.82000E 00    0.0
   5    1.36400E 01    0.0

KR TABLE FOR I,J,M,N,L =   11   17    0    0    3
   1    0.0            1.00000E 00
   2    1.28700E 00    1.00000E 00
   3    1.28829E 00    0.0
   4    1.28700E 01    0.0
   5    2.57400E 01    0.0

KR TABLE FOR I,J,M,N,L =   12   18    0    0    1
   1    0.0            1.00000E 00
   2    4.50000E-02    1.00000E 00
   3    4.50450E-02    0.0
   4    4.50000E-01    0.0
   5    9.00000E-01    0.0

KR TABLE FOR I,J,M,N,L =   12   18    0    0    2
   1    0.0            1.00000E 00
   2    6.82000E-01    1.00000E 00
   3    6.82682E-01    0.0
   4    6.82000E 00    0.0
   5    1.36400E 01    0.0

KR TABLE FOR I,J,M,N,L =   12   18    0    0    3
   1    0.0            1.00000E 00
   2    1.28700E 00    1.00000E 00
   3    1.28829E 00    0.0
   4    1.2€700E 01    0.0
   5    2.57400E 01    0.0


DRI ELEMENTS

  I  J
30 32


I,J,M,N
K-MATRIX FOR INTERNAL BEAM IJ
   1  2  0  0
     1.29292D 06   0.0           0.0           0.0           0.0           0.0
     0.0           6.10052D 04   0.0           0.0           0.0          -1.52513D 05
     0.0           0.0           4.21574D 06   0.0           1.05393D 07   0.0
     0.0           0.0           0.0           3.39424D 06   0.0           0.0
     0.0           0.0           1.05393D 07   0.0           3.51312D 07   0.0
     0.0          -1.52513D 05   0.0           0.0           0.0           5.08376D 05
   2  3  0  0
     5.87689D 05   0.0           0.0           0.0           0.0           0.0
     0.0           5.72926D ^3   0.0           0.0           0.0          -3.15109D 04
     0.0           0.0           3.95918D 05   0.0           2.17755D 06   0.0
     0.0           0.0           0.0           1.54284D 06   0.0           0.0
     0.0           0.0           2.17755D 06   0.0           1.59687D 07   0.0
     0.0          -3.15109D 04   0.0           0.0           0.0           2.31080D 05
   3  4  0  0
     5.38715D 05   0.0           0.0           0.0           0.0           0.0
     0.0           4.41299D 03   0.0           0.0           0.0          -2.64779D 04
```

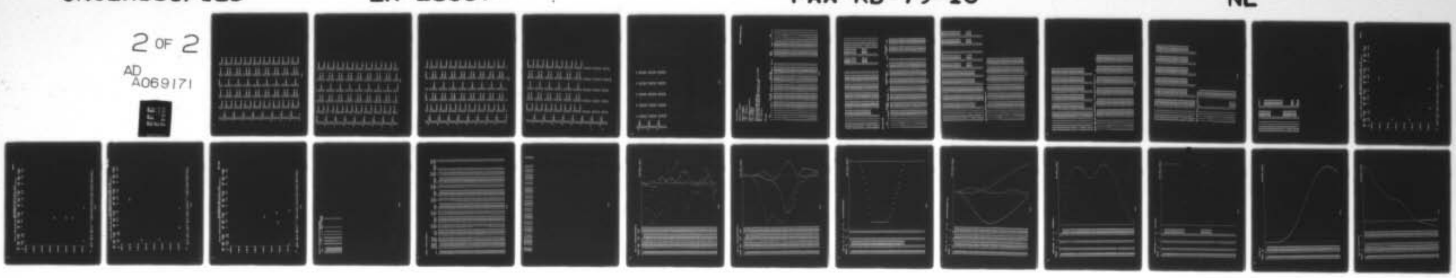
```
    0.0          0.0          3.04958D 05  0.0          1.82975D 06  0.0
    0.0          0.0          0.0          1.41427D 06  0.0          0.0
    0.0          0.0          1.82975D 06  0.0          1.46380D 07  0.0
    0.0         -2.64779D 04  0.0          0.0          0.0          2.11824D 05
  4  5  0  0
    5.87689D 05  0.0          0.0          0.0          0.0          0.0
    0.0          5.72926D 03  0.0          0.0          0.0         -3.15109D 04
    0.0          0.0          3.95918D 05  0.0          2.17755D 06  0.0
    0.0          0.0          0.0          1.54284D 06  0.0          0.0
    0.0          0.0          2.17755D 06  0.0          1.59687D 07  0.0
    0.0         -3.15109D 04  0.0          0.0          0.0          2.31080D 05
  5  6  0  0
    9.23511D 05  0.0          0.0          0.0          0.0          0.0
    0.0          2.22322D 04  0.0          0.0          0.0         -7.78127D 04
    0.0          0.0          1.53635D 06  0.0          5.37722D 06  0.0
    0.0          0.0          0.0          2.42446D 06  0.0          0.0
    0.0          0.0          5.37722D 06  0.0          2.50937D 07  0.0
    0.0         -7.78127D 04  0.0          0.0          0.0          3.63126D 05
  7  8  0  0
    2.68800D 05  0.0          0.0          0.0          0.0          0.0
    0.0          4.30083D 04  0.0          0.0          0.0         -1.07521D 05
    0.0          0.0          3.44494D 05  0.0          8.61235D 05  0.0
    0.0          0.0          0.0          3.07542D 05  0.0          0.0
    0.0          0.0          8.61235D 05  0.0          2.87078D 06  0.0
    0.0         -1.07521D 05  0.0          0.0          0.0          3.58403D 05
  8  9  0  0
    1.22182D 05  0.0          0.0          0.0          0.0          0.0
    0.0          4.03910D 03  0.0          0.0          0.0         -2.22150D 04
    0.0          0.0          3.23529D 04  0.0          1.77941D 05  0.0
    0.0          0.0          0.0          1.39792D 05  0.0          0.0
    0.0          0.0          1.77941D 05  0.0          1.30490D 06  0.0
    0.0         -2.22150D 04  0.0          0.0          0.0          1.62910D 05
  9 10  0  0
    1.12000D 05  0.0          0.0          0.0          0.0          0.0
    0.0          3.11114D 03  0.0          0.0          0.0         -1.86668D 04
    0.0          0.0          2.49200D 04  0.0          1.49520D 05  0.0
    0.0          0.0          0.0          1.28142D 05  0.0          0.0
    0.0          0.0          1.49520D 05  0.0          1.19616D 06  0.0
    0.0         -1.86668D 04  0.0          0.0          0.0          1.49335D 05
 10 11  0  0
    1.22182D 05  0.0          0.0          0.0          0.0          0.0
    0.0          4.03910D 03  0.0          0.0          0.0         -2.22150D 04
    0.0          0.0          3.23529D 04  0.0          1.77941D 05  0.0
    0.0          0.0          0.0          1.39792D 05  0.0          0.0
    0.0          0.0          1.77941D 05  0.0          1.30490D 06  0.0
    0.0         -2.22150D 04  0.0          0.0          0.0          1.62910D 05
 11 12  0  0
    1.92000D 05  0.0          0.0          0.0          0.0          0.0
    0.0          1.56736D 04  0.0          0.0          0.0         -5.48576D 04
    0.0          0.0          1.25544D 05  0.0          4.39406D 05  0.0
    0.0          0.0          0.0          2.19673D 05  0.0          0.0
    0.0          0.0          4.39406D 05  0.0          2.05056D 06  0.0
    0.0         -5.48576D 04  0.0          0.0          0.0          2.56002D 05
  1  0  0  0
    2.53120D 05  0.0          0.0          0.0          0.0          0.0
    0.0          3.10020D 02  0.0          0.0          0.0         -1.86012D 03
    0.0          0.0          1.36646D 05  0.0          8.19875D 05  0.0
    0.0          0.0          0.0          6.26084D 05  0.0          0.0
    0.0          0.0          8.19875D 05  0.0          6.55900D 06  0.0
    0.0         -1.86012D 03  0.0          0.0          0.0          1.48810D 04
```

```
2  0  0  0
   2.53120D 05   0.0           0.0           0.0           0.0           0.0
   0.0           3.10020D 02   0.0           0.0           0.0          -1.86012D 03
   0.0           0.0           1.36646D 05   0.0           8.19875D 05   0.0
   0.0           0.0           0.0           6.26084D 05   0.0           0.0
   0.0           0.0           8.19875D 05   0.0           6.55900D 06   0.0
   0.0          -1.86012D 03   0.0           0.0           0.0           1.48810D 04
3  0  0  0
   2.53120D 05   0.0           0.0           0.0           0.0           0.0
   0.0           3.10020D 02   0.0           0.0           0.0          -1.86012D 03
   0.0           0.0           1.36646D 05   0.0           8.19875D 05   0.0
   0.0           0.0           0.0           6.26084D 05   0.0           0.0
   0.0           0.0           8.19875D 05   0.0           6.55900D 06   0.0
   0.0          -1.86012D 03   0.0           0.0           0.0           1.48810D 04
4  0  0  0
   2.53120D 05   0.0           0.0           0.0           0.0           0.0
   0.0           3.10020D 02   0.0           0.0           0.0          -1.86012D 03
   0.0           0.0           1.36646D 05   0.0           8.19875D 05   0.0
   0.0           0.0           0.0           6.26084D 05   0.0           0.0
   0.0           0.0           8.19875D 05   0.0           6.55900D 06   0.0
   0.0          -1.86012D 03   0.0           0.0           0.0           1.48810D 04
5  0  0  0
   2.53120D 05   0.0           0.0           0.0           0.0           0.0
   0.0           3.10020D 02   0.0           0.0           0.0          -1.86012D 03
   0.0           0.0           1.36646D 05   0.0           8.19875D 05   0.0
   0.0           0.0           0.0           6.26084D 05   0.0           0.0
   0.0           0.0           8.19875D 05   0.0           6.55900D 06   0.0
   0.0          -1.86012D 03   0.0           0.0           0.0           1.48810D 04
6  0  0  0
   2.53120D 05   0.0           0.0           0.0           0.0           0.0
   0.0           3.10020D 02   0.0           0.0           0.0          -1.86012D 03
   0.0           0.0           1.36646D 05   0.0           8.19875D 05   0.0
   0.0           0.0           0.0           6.26084D 05   0.0           0.0
   0.0           0.0           8.19875D 05   0.0           6.55900D 06   0.0
   0.0          -1.86012D 03   0.0           0.0           0.0           1.48810D 04
1  7  0  0
   1.63823D 05   0.0           0.0           0.0           0.0           0.0
   0.0           1.87948D 02   0.0           0.0           0.0          -1.31564D 03
   0.0           0.0           3.57204D 04   0.0           2.50043D 05   0.0
   0.0           0.0           0.0           2.23429D 05   0.0           0.0
   0.0           0.0           2.50043D 05   0.0           2.33373D 06   0.0
   0.0          -1.31564D 03   0.0           0.0           0.0           1.22793D 04
2  8  0  0
   1.63823D 05   0.0           0.0           0.0           0.0           0.0
   0.0           1.87948D 02   0.0           0.0           0.0          -1.31564D 03
   0.0           0.0           3.57204D 04   0.0           2.50043D 05   0.0
   0.0           0.0           0.0           2.23429D 05   0.0           0.0
   0.0           0.0           2.50043D 05   0.0           2.33373D 06   0.0
   0.0          -1.31564D 03   0.0           0.0           0.0           1.22793D 04
3  9  0  0
   1.63823D 05   0.0           0.0           0.0           0.0           0.0
   0.0           1.87948D 02   0.0           0.0           0.0          -1.31564D 03
   0.0           0.0           3.57204D 04   0.0           2.50043D 05   0.0
   0.0           0.0           0.0           2.23429D 05   0.0           0.0
   0.0           0.0           2.50043D 05   0.0           2.33373D 06   0.0
   0.0          -1.31564D 03   0.0           0.0           0.0           1.22793D 04
4 10  0  0
   1.63823D 05   0.0           0.0           0.0           0.0           0.0
   0.0           1.87948D 02   0.0           0.0           0.0          -1.31564D 03
   0.0           0.0           3.57204D 04   0.0           2.50043D 05   0.0
```

AD-A069 171 LOCKHEED-CALIFORNIA CO BURBANK F/G 1/3
SUMMARY OF RESULTS FOR A TWIN-ENGINE, LOW-WING AIRPLANE SUBSTRU--ETC(U)
JAN 79 G WITTLIN DOT-FA75WA-3707
UNCLASSIFIED LR-28869 FAA-RD-79-13 NL

2 OF 2

AD
A069171



END
DATE
FILMED
7-79
DDC

	0.0	0.0	0.0	2.234290 05	0.0	0.0
	0.0	0.0	2.500430 05	0.0	2.333730 06	0.0
	0.0	-1.315640 03	0.0	0.0	0.0	1.227930 04
5 11 0 0						
	1.638230 05	0.0	0.0	0.0	0.0	0.0
	0.0	1.879480 02	0.0	0.0	0.0	-1.315640 03
	0.0	0.0	3.572040 04	0.0	2.500430 05	0.0
	0.0	0.0	0.0	2.234290 05	0.0	0.0
	0.0	0.0	2.500430 05	0.0	2.333730 06	0.0
	0.0	-1.315640 03	0.0	0.0	0.0	1.227930 04
6 12 0 0						
	1.638230 05	0.0	0.0	0.0	0.0	0.0
	0.0	1.879480 02	0.0	0.0	0.0	-1.315640 03
	0.0	0.0	3.572040 04	0.0	2.500430 05	0.0
	0.0	0.0	0.0	2.234290 05	0.0	0.0
	0.0	0.0	2.500430 05	0.0	2.333730 06	0.0
	0.0	-1.315640 03	0.0	0.0	0.0	1.227930 04
7 13 0 0						
	4.705410 04	0.0	0.0	0.0	0.0	0.0
	0.0	6.895450 02	0.0	0.0	0.0	-9.049870 03
	0.0	0.0	2.473960 01	0.0	3.246920 02	0.0
	0.0	0.0	0.0	1.562360 04	0.0	0.0
	0.0	0.0	3.246920 02	0.0	5.681860 03	0.0
	0.0	-9.049870 03	0.0	0.0	0.0	1.583660 05
8 14 0 0						
	4.705410 04	0.0	0.0	0.0	0.0	0.0
	0.0	6.895450 02	0.0	0.0	0.0	-9.049870 03
	0.0	0.0	2.473960 01	0.0	3.246920 02	0.0
	0.0	0.0	0.0	1.562360 04	0.0	0.0
	0.0	0.0	3.246920 02	0.0	5.681860 03	0.0
	0.0	-9.049870 03	0.0	0.0	0.0	1.583660 05
9 15 0 0						
	4.705410 04	0.0	0.0	0.0	0.0	0.0
	0.0	6.895450 02	0.0	0.0	0.0	-9.049870 03
	0.0	0.0	2.473960 01	0.0	3.246920 02	0.0
	0.0	0.0	0.0	1.562360 04	0.0	0.0
	0.0	0.0	3.246920 02	0.0	5.681860 03	0.0
	0.0	-9.049870 C3	0.0	0.0	0.0	1.583660 05
10 16 0 0						
	4.705410 04	0.0	0.0	0.0	0.0	0.0
	0.0	6.895450 02	0.0	0.0	0.0	-9.049870 03
	0.0	0.0	2.473960 01	0.0	3.246920 02	0.0
	0.0	0.0	0.0	1.562360 04	0.0	0.0
	0.0	0.0	3.246920 02	0.0	5.681860 03	0.0
	0.0	-9.049870 03	0.0	0.0	0.0	1.583660 05
11 17 0 0						
	1.791120 05	0.0	0.0	0.0	0.0	0.0
	0.0	2.150170 03	0.0	0.0	0.0	-2.821970 04
	0.0	0.0	9.110660 01	0.0	1.195720 03	0.0
	0.0	0.0	0.0	4.902350 04	0.0	0.0
	0.0	0.0	1.195720 03	0.0	2.092410 04	0.0
	0.0	-2.821970 C4	0.0	0.0	0.0	4.938220 05
12 18 0 0						
	4.705410 04	0.0	0.0	0.0	0.0	0.0
	0.0	6.895450 02	0.0	0.0	0.0	-9.049870 03
	0.0	0.0	2.473960 01	0.0	3.246920 02	0.0
	0.0	0.0	0.0	1.562360 04	0.0	0.0
	0.0	C.0	3.246920 02	0.0	5.681860 03	0.0
	0.0	-9.049870 03	0.0	0.0	0.0	1.583660 05
17 22 0 0						

```
    5.61416D 04  0.0          0.0          0.0          0.0          0.0
    0.0          1.17118D 03  0.0          0.0          0.0         -1.28830D 04
    0.0          0.0          4.20197D 01  0.0          4.62217D 02  0.0
    0.0          0.0          0.0          1.86409D 04  0.0          0.0
    0.0          0.0          4.62217D 02  0.0          6.77918D 03  0.0
    0.0         -1.28830D 04  0.0          0.0          0.0          1.88950D 05
18 23  0  0
    5.61416D 04  0.0          0.0          0.0          0.0          0.0
    0.0          1.17118D 03  0.0          0.0          0.0         -1.28830D 04
    0.0          0.0          4.20197D 01  0.0          4.62217D 02  0.0
    0.0          0.0          0.0          1.86409D 04  0.0          0.0
    0.0          0.0          4.62217D 02  0.0          6.77918D 03  0.0
    0.0         -1.28830D 04  0.0          0.0          0.0          1.88950D 05
14 19  0  0
    1.12283D 05  0.0          0.0          0.0          0.0          0.0
    0.0          2.34236D 03  0.0          0.0          0.0         -2.57660D 04
    0.0          0.0          4.21902D 04  0.0          4.64093D 05  0.0
    0.0          0.0          0.0          6.84247D 05  0.0          0.0
    0.0          0.0          4.64093D 05  0.0          6.80669D 06  0.0
    0.0         -2.57660D 04  0.0          0.0          0.0          3.77901D 05
19 24  0  0
    3.82993D 04  0.0          0.0          0.0          0.0          0.0
    0.0          1.33405D 01  0.0          0.0          0.0         -2.15109D 02
    0.0          0.0          3.71828D 02  0.0          5.99554D 03  0.0
    0.0          0.0          0.0          1.27167D 04  0.0          0.0
    0.0          0.0          5.99554D 03  0.0          1.28900D 05  0.0
    0.0         -2.15109D 02  0.0          0.0          0.0          4.62470D 03
20 25  0  0
    3.82993D 04  0.0          0.0          0.0          0.0          0.0
    0.0          1.33405D 01  0.0          0.0          0.0         -2.15109D 02
    0.0          0.0          3.71828D 02  0.0          5.99554D 03  0.0
    0.0          0.0          0.0          1.27167D 04  0.0          0.0
    0.0          0.0          5.99554D 03  0.0          1.28900D 05  0.0
    0.0         -2.15109D 02  0.0          0.0          0.0          4.62470D 03
21 26  0  0
    3.82993D 04  0.0          0.0          0.0          0.0          0.0
    0.0          1.33405D 01  0.0          0.0          0.0         -2.15109D 02
    0.0          0.0          3.71828D 02  0.0          5.99554D 03  0.0
    0.0          0.0          0.0          1.27167D 04  0.0          0.0
    0.0          0.0          5.99554D 03  0.0          1.28900D 05  0.0
    0.0         -2.15109D 02  0.0          0.0          0.0          4.62470D 03
22 27  0  0
    3.82993D 04  0.0          0.0          0.0          0.0          0.0
    0.0          1.33405D 01  0.0          0.0          0.0         -2.15109D 02
    0.0          0.0          3.71828D 02  0.0          5.99554D 03  0.0
    0.0          0.0          0.0          1.27167D 04  0.0          0.0
    0.0          0.0          5.99554D 03  0.0          1.28900D 05  0.0
    0.0         -2.15109D 02  0.0          0.0          0.0          4.62470D 03
23 28  0  0
    3.82993D 04  0.0          0.0          0.0          0.0          0.0
    0.0          1.33405D 01  0.0          0.0          0.0         -2.15109D 02
    0.0          0.0          3.71828D 02  0.0          5.99554D 03  0.0
    0.0          0.0          0.0          1.27167D 04  0.0          0.0
    0.0          0.0          5.99554D 03  0.0          1.28900D 05  0.0
    0.0         -2.15109D 02  0.0          0.0          0.0          4.62470D 03
13 14  0  0
    3.31023D 05  0.0          0.0          0.0          0.0          0.0
    0.0          4.29097D 05  0.0          0.0          0.0         -1.07274D 06
    0.0          0.0          1.13944D 04  0.0          2.84861D 04  0.0
    0.0          0.0          0.0          3.49596D 05  0.0          0.0
```

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      0.0          0.0          2.04861D 04  0.0          9.49536D 04  0.0
      0.0         -1.07274D 06  0.0          0.0          0.0          3.57580D 06
   14 15  0  0
      1.50465D 05  0.0          0.0          0.0          0.0          0.0
      0.0          4.02983D 04  0.0          0.0          0.0         -2.21641D 05
      0.0          0.0          1.07010D 03  0.0          5.88555D 03  0.0
      0.0          0.0          0.0          1.58907D 05  0.0          0.0
      0.0          0.0          5.88555D 03  0.0          4.31607D 04  0.0
      0.0         -2.21641D 05  0.0          0.0          0.0          1.62537D 06
   15 16  0  0
      1.37926D 05  0.0          0.0          0.0          0.0          0.0
      0.0          3.10400D 04  0.0          0.0          0.0         -1.86240D 05
      0.0          0.0          8.24250D 02  0.0          4.94550D 03  0.0
      0.0          0.0          0.0          1.45665D 05  0.0          0.0
      0.0          0.0          4.94550D 03  0.0          3.95640D 04  0.0
      0.0         -1.86240D 05  0.0          0.0          0.0          1.48992D 06
   16 17  0  0
      1.50465D 05  0.0          0.0          0.0          0.0          0.0
      0.0          4.02983D 04  0.0          0.0          0.0         -2.21641D 05
      0.0          0.0          1.07010D 03  0.0          5.88555D 03  0.0
      0.0          0.0          0.0          1.58907D 05  0.0          0.0
      0.0          0.0          5.88555D 03  0.0          4.31607D 04  0.0
      0.0         -2.21641D 05  0.0          0.0          0.0          1.62537D 06
   17 18  0  0
      2.36445D 05  0.0          0.0          0.0          0.0          0.0
      0.0          1.54376D 05  0.0          0.0          0.0         -5.47317D 05
      0.0          0.0          4.15249D 03  0.0          1.45337D 04  0.0
      0.0          0.0          0.0          2.49711D 05  0.0          0.0
      0.0          0.0          1.45337D 04  0.0          6.78240D 04  0.0
      0.0         -5.47317D 05  0.0          0.0          0.0          2.55415D 06
   19 20  0  0
      3.15115D 05  0.0          0.0          0.0          0.0          0.0
      0.0          1.67943D 06  0.0          0.0          0.0         -9.23686D 05
      0.0          0.0          3.59553D 05  0.0          1.97754D 06  0.0
      0.0          0.0          0.0          7.83228D 06  0.0          0.0
      0.0          0.0          1.97754D 06  0.0          1.45020D 07  0.0
      0.0         -9.23686D 06  0.0          0.0          0.0          6.77370D 07
   20 21  0  0
      2.88855D 05  0.0          0.0          0.0          0.0          0.0
      0.0          1.29359D 06  0.0          0.0          0.0         -7.76153D 06
      0.0          0.0          2.76947D 05  0.0          1.66168D 06  0.0
      0.0          0.0          0.0          7.17959D 06  0.0          0.0
      0.0          0.0          1.66168D 06  0.0          1.32935D 07  0.0
      0.0         -7.76153D 06  0.0          0.0          0.0          6.20922D 07
   21 22  0  0
      3.15115D 05  0.0          0.0          0.0          0.0          0.0
      0.0          1.67943D 06  0.0          0.0          0.0         -9.23686D 06
      0.0          0.0          3.59553D 05  0.0          1.97754D 06  0.0
      0.0          0.0          0.0          7.83228D 06  0.0          0.0
      0.0          0.0          1.97754D 06  0.0          1.45020D 07  0.0
      0.0         -9.23686D 06  0.0          0.0          0.0          6.77370D 07
   22 23  0  0
      4.95180D 05  0.0          0.0          0.0          0.0          0.0
      0.0          6.51697D 06  0.0          0.0          0.0         -2.28094D 07
      0.0          0.0          1.39523D 06  0.0          4.88331D 06  0.0
      0.0          0.0          0.0          1.23079D 07  0.0          0.0
      0.0          0.0          4.88331D 06  0.0          2.27888D 07  0.0
      0.0         -2.28094D 07  0.0          0.0          0.0          1.06444D 08
    3 29  0  1
      1.31[illegible]90 05  0.0          0.0          0.0          0.0          0.0
```

```
   0.0          2.215990 04   0.0           0.0           0.0          -1.584430 05
   0.0          0.0           7.386620 03   0.0           5.281430 04   0.0
   0.0          0.0           0.0           1.913290 05   0.0           0.0
   0.0          0.0           5.281430 04   0.0           5.034970 05   0.0
   0.0         -1.584430 05   0.0           0.0           0.0           1.510490 06
 5 29  0  2
   1.314690 05  0.0           0.0           0.0           0.0           0.0
   0.0          2.215990 04   0.0           0.0           0.0          -1.584430 05
   0.0          0.0           7.386620 03   0.0           5.281430 04   0.0
   0.0          0.0           0.0           1.913290 05   0.0           0.0
   0.0          0.0           5.281430 04   0.0           5.034970 05   0.0
   0.0         -1.584430 05   0.0           0.0           0.0           1.510490 06
 9 29  0  3
   1.314690 05  0.0           0.0           0.0           0.0           0.0
   0.0          2.215990 04   0.0           0.0           0.0          -1.584430 05
   0.0          0.0           7.386620 03   0.0           5.281430 04   0.0
   0.0          0.0           0.0           1.913290 05   0.0           0.0
   0.0          0.0           5.281430 04   0.0           5.034970 05   0.0
   0.0         -1.584430 05   0.0           0.0           0.0           1.510490 06
11 29  0  4
   1.314690 05  0.0           0.0           0.0           0.0           0.0
   0.0          2.215990 04   0.0           0.0           0.0          -1.584430 05
   0.0          0.0           7.386620 03   0.0           5.281430 04   0.0
   0.0          0.0           0.0           1.913290 05   0.0           0.0
   0.0          0.0           5.281430 04   0.0           5.034970 05   0.0
   0.0         -1.584430 05   0.0           0.0           0.0           1.510490 06
30 31  0  0
   1.391650 04  0.0           0.0           0.0           0.0           0.0
   0.0          2.750200 02   0.0           0.0           0.0          -2.075020 03
   0.0          0.0           2.750200 02   0.0           2.075020 03   0.0
   0.0          0.0           0.0           3.976140 03   0.0           0.0
   0.0          0.0           2.075020 03   0.0           2.087480 04   0.0
   0.0         -2.075020 03   0.0           0.0           0.0           2.087480 04
30 32  0  0
   4.769120 02  0.0           0.0           0.0           0.0           0.0
   0.0          1.676310 01   0.0           0.0           0.0          -1.264780 02
   0.0          0.0           1.676310 01   0.0           1.264780 02   0.0
   0.0          0.0           0.0           1.908550 02   0.0           0.0
   0.0          0.0           1.264780 02   0.0           1.272370 03   0.0
   0.0         -1.264780 02   0.0           0.0           0.0           1.272370 03
 5 30  0  0
   9.338610 02  0.0           0.0           0.0           0.0           0.0
   0.0          0.0           0.0           0.0           0.0           0.0
   0.0          0.0           0.0           0.0           0.0           0.0
   0.0          0.0           0.0           0.0           0.0           0.0
   0.0          0.0           0.0           0.0           0.0           0.0
   0.0          0.0           0.0           0.0           0.0           0.0
11 30  0  0
   9.338610 02  0.0           0.0           0.0           0.0           0.0
   0.0          0.0           0.0           0.0           0.0           0.0
   0.0          0.0           0.0           0.0           0.0           0.0
   0.0          0.0           0.0           0.0           0.0           0.0
   0.0          0.0           0.0           0.0           0.0           0.0
   0.0          0.0           0.0           0.0           0.0           0.0
29 30  0  0
   5.334000 02  0.0           0.0           0.0           0.0           0.0
   0.0          0.0           0.0           0.0           0.0           0.0
   0.0          0.0           0.0           0.0           0.0           0.0
   0.0          0.0           0.0           0.0           0.0           0.0
   0.0          0.0           0.0           0.0           0.0           0.0
```

```
   0.0           0.0         0.0         0.0         0.0         0.0
29 30  5  1
   1.638000 03   0.0         0.0         0.0         0.0         0.0
   0.0           0.0         0.0         0.0         0.0         0.0
   0.0           0.0         0.0         0.0         0.0         0.0
   0.0           0.0         0.0         0.0         0.0         0.0
   0.0           0.0         0.0         0.0         0.0         0.0
   0.0           0.0         0.0         0.0         0.0         0.0
14  0  0  0
   5.916960 04   0.0         0.0         0.0         0.0         0.0
   0.0           0.0         0.0         0.0         0.0         0.0
   0.0           0.0         0.0         0.0         0.0         0.0
   0.0           0.0         0.0         0.0         0.0         0.0
   0.0           0.0         0.0         0.0         0.0         0.0
   0.0           0.0         0.0         0.0         0.0         0.0
18  0  0  0
   5.916960 04   0.0         0.0         0.0         0.0         0.0
   0.0           0.0         0.0         0.0         0.0         0.0
   0.0           0.0         0.0         0.0         0.0         0.0
   0.0           0.0         0.0         0.0         0.0         0.0
   0.0           0.0         0.0         0.0         0.0         0.0
   0.0           0.0         0.0         0.0         0.0         0.0
```

MODEL PARAMETERS

MODEL PARAMETER DATA

VEHICLE WT = 5.436600D 02

VEHICLE CG POSITION
X (FS) = 1.62560D 02
Y (BL) = 0.0
Z (WL) = 5.32205D 00

VEHICLE INERTIAS (IN-LB-SEC**2)
I(XX) = 8.15026D 02
I(YY) = 6.06355D 02
I(ZZ) = 5.13955D 02

VEHICLE CG INITIAL GROUND COORDINATES
XCG IS THE DISTANCE FROM SLOPE/GROUND INTERSECTION TO VEHICLE CG,+FORWARD
ZCG IS THE DISTANCE FROM GROUND PLANE TO VEHICLE CG,+DOWN
XCG = 0.0
ZCG = -2.95621D 01

BEAM LOADS

	BEAM					AXIAL LOAD		SHEAR FORCE			MOMENT			BEAM			
IJ	I	J	M	N	BUCKLING	TENSION	COMPRESSION	LATERAL(Y)	VERTICAL(Z)	ROLL(X)	PITCH(Y)	YAW(Z)	IJ	I	J	M	N
1	1	2	0	0	1.0035D 06	2.8937D 04	2.4011D 04	9.0750D 03	9.0750D 03	0.0	2.8220D 04	3.5387D 03	1	1	2	0	0
2	2	3	0	0	2.0733D 05	2.8937D 04	2.4011D 04	9.0750D 03	9.0750D 03	0.0	2.8220D 04	3.5387D 03	2	2	3	0	0
3	3	4	0	0	1.7422D 05	2.8937D 04	2.4011D 04	9.0750D 03	9.0750D 03	0.0	2.8220D 04	3.5387D 03	3	3	4	0	0
4	4	5	0	0	2.0733D 05	2.8937D 04	2.4011D 04	9.0750D 03	9.0750D 03	0.0	2.8220D 04	3.5387D 03	4	4	5	0	0
5	5	6	0	0	5.1199D 05	2.8937D 04	2.4011D 04	9.0750D 03	9.0750D 03	0.0	2.8220D 04	3.5387D 03	5	5	6	0	0
6	7	8	0	0	7.0746D 05	6.0160D 03	4.9920D 03	1.8867D 03	1.8867D 03	0.0	8.0780D 03	1.6640D 03	6	7	8	0	0
7	8	9	0	0	1.4617D 05	6.0160D 03	4.9920D 03	1.8867D 03	1.8867D 03	0.0	8.0780D 03	1.6640D 03	7	8	9	0	0
8	9	10	0	0	1.2282D 05	6.0160D 03	4.9920D 03	1.8867D 03	1.8867D 03	0.0	8.0780D 03	1.6640D 03	8	9	10	0	0
9	10	11	0	0	1.4617D 05	6.0160D 03	4.9920D 03	1.8867D 03	1.8867D 03	0.0	8.0780D 03	1.6640D 03	9	10	11	0	0
10	11	12	0	0	3.6095D 05	6.0160D 03	4.9920D 03	1.8867D 03	1.8867D 03	0.0	8.0780D 03	1.6640D 03	10	11	12	0	0
11	1	0	0	0	1.2239D 04	1.3596D 04	1.1282D 04	4.2640D 03	4.2640D 03	0.0	1.8597D 04	2.9400D 02	11	1	0	0	0
12	2	0	0	0	1.2239D 04	1.3596D 04	1.1282D 04	4.2640D 03	4.2640D 03	0.0	1.8597D 04	2.9400D 02	12	2	0	0	0
13	3	0	0	0	1.2239D 04	1.3596D 04	1.1282D 04	4.2640D 03	4.2640D 03	0.0	1.8597D 04	2.9400D 02	13	3	0	0	0
14	4	0	0	0	1.2239D 04	1.3596D 04	1.1282D 04	4.2640D 03	4.2640D 03	0.0	1.8597D 04	2.9400D 02	14	4	0	0	0
15	5	0	0	0	1.2239D 04	1.3596D 04	1.1282D 04	4.2640D 03	4.2640D 03	0.0	1.8597D 04	2.9400D 02	15	5	0	0	0
16	6	0	0	0	1.2239D 04	1.3596D 04	1.1282D 04	4.2640D 03	4.2640D 03	0.0	1.8597D 04	2.9400D 02	16	6	0	0	0
17	1	7	0	0	8.6566D 03	1.0266D 04	8.5188D 03	3.2197D 03	3.2197D 03	0.0	1.0758D 04	2.9024D 02	17	1	7	0	0
18	2	8	0	0	8.6566D 03	1.0266D 04	8.5188D 03	3.2197D 03	3.2197D 03	0.0	1.0758D 04	2.9024D 02	18	2	8	0	0
19	3	9	0	0	8.6566D 03	1.0266D 04	8.5188D 03	3.2197D 03	3.2197D 03	0.0	1.0758D 04	2.9024D 02	19	3	9	0	0
20	4	10	0	0	8.6566D 03	1.0266D 04	8.5188D 03	3.2197D 03	3.2197D 03	0.0	1.0758D 04	2.9024D 02	20	4	10	0	0
21	5	11	0	0	8.6566D 03	1.0266D 04	8.5188D 03	3.2197D 03	3.2197D 03	0.0	1.0758D 04	2.9024D 02	21	5	11	0	0
22	6	12	0	0	8.6566D 03	1.0266D 04	8.5188D 03	3.2197D 03	3.2197D 03	0.0	1.0758D 04	2.9024D 02	22	6	12	0	0
23	7	13	0	0	2.1364D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	1.2043D 03	3.0880D 03	23	7	13	0	0
24	8	14	0	0	2.1364D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	1.2043D 03	3.0880D 03	24	8	14	0	0
25	9	15	0	0	2.1364D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	1.2043D 03	3.0880D 03	25	9	15	0	0
26	10	16	0	0	2.1364D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	1.2043D 03	3.0880D 03	26	10	16	0	0
27	11	17	0	0	7.8675D 03	2.1045D 04	1.7463D 04	6.6000D 03	6.6000D 03	0.0	7.6924D 02	9.6291D 03	27	11	17	0	0
28	12	18	0	0	2.1364D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	1.2043D 03	3.0880D 03	28	12	18	0	0
29	17	22	0	0	3.0413D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	1.2043D 03	3.0880D 03	29	17	22	0	0
30	18	23	0	0	3.0413D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	1.2043D 03	3.0880D 03	30	18	23	0	0
31	14	19	0	0	1.6953D 05	1.1057D 04	9.1751D 03	3.4677D 03	3.4677D 03	0.0	4.5000D 04	6.1760D 03	31	14	19	0	0
32	19	24	0	0	1.4154D 03	5.5286D 03	4.5876D 03	1.7339D 03	1.7339D 03	0.0	3.0880D 03	1.2043D 03	32	19	24	0	0

33	20	25	0	0	1.41540 03	5.52860 03	4.58760 03	1.73390 03	1.73390 03	0.0	3.08800 03	1.20430 03	33	20	25	0	0
34	21	26	0	0	1.41540 03	5.52860 03	4.58760 03	1.73390 03	1.73390 03	0.0	3.08800 03	1.20430 03	34	21	26	0	0
35	22	27	0	0	1.41540 03	5.52860 03	4.58760 03	1.73390 03	1.73390 03	0.0	3.08800 03	1.20430 03	35	22	27	0	0
36	23	28	0	0	1.41540 03	5.52860 03	4.58760 03	1.73390 03	1.73390 03	0.0	3.08800 03	1.20430 03	36	23	28	0	0
37	13	14	0	0	1.87430 05	7.40860 03	6.14760 03	2.32350 03	2.32350 03	0.0	5.60170 02	1.71510 04	37	13	14	0	0
38	14	15	0	0	3.87250 04	7.40860 03	6.14760 03	2.32350 03	2.32350 03	0.0	5.60170 02	1.71510 04	38	14	15	0	0
39	15	16	0	0	3.25400 04	7.40860 03	6.14760 03	2.32350 03	2.32350 03	0.0	5.60170 02	1.71510 04	39	15	16	0	0
40	16	17	0	0	3.87250 04	7.40860 03	6.14760 03	2.32350 03	2.32350 03	0.0	5.60170 02	1.71510 04	40	16	17	0	0
41	17	18	0	0	9.56280 04	7.40860 03	6.14760 03	2.32350 03	2.32350 03	0.0	5.60170 02	1.71510 04	41	17	18	0	0
42	19	20	0	0	1.30120 07	1.55160 04	1.28750 04	4.86600 03	4.86600 03	0.0	0.0	0.0	42	19	20	0	0
43	20	21	0	0	1.09330 07	1.55160 04	1.28750 04	4.86600 03	4.86600 03	0.0	0.0	0.0	43	20	21	0	0
44	21	22	0	0	1.30120 07	1.55160 04	1.28750 04	4.86600 03	4.86600 03	0.0	0.0	0.0	44	21	22	0	0
45	22	23	0	0	3.21310 07	1.55160 04	1.28750 04	4.86600 03	4.86600 03	0.0	0.0	0.0	45	22	23	0	0
46	3	29	0	1	3.47500 05	3.00800 03	3.00800 03	2.14130 03	2.14130 03	0.0	4.80000 04	1.44000 05	46	3	29	0	1
47	5	29	0	2	3.47500 05	3.00800 03	3.00800 03	2.14130 03	2.14130 03	0.0	4.80000 04	1.44000 05	47	5	29	0	2
48	9	29	0	3	3.47500 05	3.00800 03	3.00800 03	2.14130 03	2.14130 03	0.0	4.80000 04	1.44000 05	48	9	29	0	3
49	11	29	0	4	3.47500 05	3.00800 03	3.00800 03	2.14130 03	2.14130 03	0.0	4.80000 04	1.44000 05	49	11	29	0	4
50	30	31	0	0	1.36530 04	9.40000 02	7.80000 02	2.94800 02	2.94800 02	0.0	0.0	0.0	50	30	31	0	0
51	30	32	0	0	8.32190 02	1.15150 02	1.15150 02	8.19690 01	8.19690 01	0.0	0.0	0.0	51	30	32	0	0
52	5	30	0	0	0.0	1.01380 02	8.41270 01	3.17960 01	3.17960 01	0.0	0.0	0.0	52	5	30	0	0
53	11	30	0	0	0.0	1.01380 02	8.41270 01	3.17960 01	3.17960 01	0.0	0.0	0.0	53	11	30	0	0
54	29	30	0	0	0.0	1.79070 01	1.48590 01	5.61590 00	5.61590 00	0.0	0.0	0.0	54	29	30	0	0
55	29	30	5	1	0.0	5.49900 01	4.56300 01	1.72460 01	1.72460 01	0.0	0.0	0.0	55	29	30	5	1
56	14	0	0	0	0.0	8.28370 03	8.28370 03	2.77510 03	2.77510 03	0.0	0.0	0.0	56	14	0	0	0
57	18	0	0	0	0.0	8.28370 03	8.28370 03	2.77510 03	2.77510 03	0.0	0.0	0.0	57	18	0	0	0

BEAM DEFLECTIONS

	BEAM					DEFLECTION			TRANSLATION DUE TO				ROTATION ABOUT	
IJ	I	J	M	N	BUCKLING	TENSION	COMPRESSION	F(Y)	F(Z)	BM(Z)	BM(Y)	X-AXIS	Y-AXIS	Z-AXIS
1	1	2	0	0	7.761D-01	2.238D-02	1.857D-02	1.488D-01	2.153D-03	4.641D-02	5.355D-03	0.0	3.213D-03	2.784D-02
2	2	3	0	0	3.528D-01	4.924D-02	4.086D-02	1.584D 00	2.292D-02	2.246D-01	2.592D-02	0.0	7.069D-03	6.126D-02
3	3	4	0	0	3.234D-01	5.371D-02	4.457D-02	2.056D 00	2.976D-02	2.673D-01	3.085D-02	0.0	7.711D-03	6.682D-02
4	4	5	0	0	3.528D-01	4.924D-02	4.086D-02	1.584D 00	2.292D-02	2.246D-01	2.592D-02	0.0	7.069D-03	6.126D-02
5	5	6	0	0	5.544D-01	3.133D-02	2.600D-02	4.082D-01	5.907D-03	9.095D-02	1.050D-02	0.0	4.498D-03	3.898D-02
6	7	8	0	0	2.632D 00	2.238D-02	1.857D-02	4.387D-02	5.477D-03	3.095D-02	1.876D-02	0.0	1.126D-02	1.857D-02
7	8	9	0	0	1.196D 00	4.924D-02	4.086D-02	4.671D-01	5.832D-02	1.498D-01	9.079D-02	0.0	2.476D-02	4.086D-02
8	9	10	0	0	1.097D 00	5.371D-02	4.457D-02	6.064D-01	7.571D-02	1.783D-01	1.081D-01	0.0	2.701D-02	4.457D-02
9	10	11	0	0	1.196D 00	4.924D-02	4.086D-02	4.671D-01	5.832D-02	1.498D-01	9.079D-02	0.0	2.476D-02	4.086D-02
10	11	12	0	0	1.880D 00	3.133D-02	2.600D-02	1.204D-01	1.503D-02	6.067D-02	3.677D-02	0.0	1.576D-02	2.600D-02
11	1	0	0	0	4.835D-02	5.371D-02	4.457D-02	1.375D 01	3.120D-02	3.161D-01	4.537D-02	0.0	1.134D-02	7.903D-02
12	2	0	0	0	4.835D-02	5.371D-02	4.457D-02	1.375D 01	3.120D-02	3.161D-01	4.537D-02	0.0	1.134D-02	7.903D-02
13	3	0	0	0	4.835D-02	5.371D-02	4.457D-02	1.375D 01	3.120D-02	3.161D-01	4.537D-02	0.0	1.134D-02	7.903D-02
14	4	0	0	0	4.835D-02	5.371D-02	4.457D-02	1.375D 01	3.120D-02	3.161D-01	4.537D-02	0.0	1.134D-02	7.903D-02
15	5	0	0	0	4.835D-02	5.371D-02	4.457D-02	1.375D 01	3.120D-02	3.161D-01	4.537D-02	0.0	1.134D-02	7.903D-02
16	6	0	0	0	4.835D-02	5.371D-02	4.457D-02	1.375D 01	3.120D-02	3.161D-01	4.537D-02	0.0	1.134D-02	7.903D-02
17	1	7	0	0	5.284D-02	6.267D-02	5.200D-02	1.713D 01	9.014D-02	4.412D-01	8.605D-02	0.0	1.844D-02	9.455D-02
18	2	8	0	0	5.284D-02	6.267D-02	5.200D-02	1.713D 01	9.014D-02	4.412D-01	8.605D-02	0.0	1.844D-02	9.455D-02
19	3	9	0	0	5.284D-02	6.267D-02	5.200D-02	1.713D 01	9.014D-02	4.412D-01	8.605D-02	0.0	1.844D-02	9.455D-02
20	4	10	0	0	5.294D-02	6.267D-02	5.200D-02	1.713D 01	9.014D-02	4.412D-01	8.605D-02	0.0	1.844D-02	9.455D-02
21	5	11	0	0	5.294D-02	6.267D-02	5.200D-02	1.713D 01	9.014D-02	4.412D-01	8.605D-02	0.0	1.844D-02	9.455D-02
22	6	12	0	0	5.234D-02	6.267D-02	5.200D-02	1.713D 01	9.014D-02	4.412D-01	8.605D-02	0.0	1.844D-02	9.455D-02
23	7	13	0	0	4.540D-02	1.175D-01	9.750D-02	2.515D 00	7.008D 01	6.824D-01	7.418D 00	0.0	8.478D-01	7.800D-02
24	8	14	0	0	4.540D-02	1.175D-01	9.750D-02	2.515D 00	7.008D 01	6.824D-01	7.418D 00	0.0	8.478D-01	7.800D-02
25	9	15	0	0	4.540D-02	1.175D-01	9.750D-02	2.515D 00	7.008D 01	6.824D-01	7.418D 00	0.0	8.478D-01	7.800D-02
26	10	16	0	0	4.540D-02	1.175D-01	9.750D-02	2.515D 00	7.008D 01	6.824D-01	7.418D 00	0.0	8.478D-01	7.800D-02
27	11	17	0	0	4.393D-02	1.175D-01	9.750D-02	3.070D 00	7.244D 01	6.824D-01	1.287D 00	0.0	1.471D-01	7.800D-02

28	12	18	0	0	4.540D-02	1.175D-01	9.750D-02	2.515D 00	7.008D 01	6.824D-01	7.418D 00	0.0	8.478D-01	7.800D-02
29	17	22	0	0	5.417D-02	9.848D-02	8.171D-02	1.480D 00	4.126D 01	4.794D-01	5.211D 00	0.0	7.106D-01	6.537D-02
30	18	23	0	0	5.417D-02	9.848D-02	8.171D-02	1.480D 00	4.126D 01	4.794D-01	5.211D 00	0.0	7.106D-01	6.537D-02
31	14	19	0	0	1.510D 00	9.848D-02	8.171D-02	1.480D 00	8.219D-02	4.794D-01	1.939D-01	0.0	2.644D-02	6.537D-02
32	19	24	0	0	3.696D-02	1.444D-01	1.198D-01	1.300D 02	4.663D 00	1.120D 01	1.030D 00	0.0	9.583D-02	1.042D 00
33	20	25	0	0	3.696D-02	1.444D-01	1.198D-01	1.300D 02	4.663D 00	1.120D 01	1.030D 00	0.0	9.583D-02	1.042D 00
34	21	26	0	0	3.696D-02	1.444D-01	1.198D-01	1.300D 02	4.663D 00	1.120D 01	1.030D 00	0.0	9.583D-02	1.042D 00
35	22	27	0	0	3.696D-02	1.444D-01	1.198D-01	1.300D 02	4.663D 00	1.120D 01	1.030D 00	0.0	9.583D-02	1.042D 00
36	23	28	0	0	3.696D-02	1.444D-01	1.198D-01	1.300D 02	4.663D 00	1.120D 01	1.030D 00	0.0	9.583D-02	1.042D 00
37	13	14	0	0	5.662D-01	2.238D-02	1.857D-02	5.415D-03	2.039D-01	3.198D-02	3.933D-02	0.0	2.360D-02	1.919D-02
38	14	15	0	0	2.574D-01	4.924D-02	4.086D-02	5.766D-02	2.171D 00	1.548D-01	1.904D-01	0.0	5.192D-02	4.221D-02
39	15	16	0	0	2.359D-01	5.371D-02	4.457D-02	7.485D-02	2.819D 00	1.842D-01	2.265D-01	0.0	5.663D-02	4.604D-02
40	16	17	0	0	2.574D-01	4.924D-02	4.086D-02	5.766D-02	2.171D 00	1.548D-01	1.904D-01	0.0	5.192D-02	4.221D-02
41	17	18	0	0	4.044D-01	3.133D-02	2.600D-02	1.486D-02	5.595D-01	6.267D-02	7.709D-02	0.0	3.304D-02	2.686D-02
42	19	20	0	0	4.129D 01	4.924D-02	4.086D-02	2.897D-03	1.353D-02	0.0	0.0	0.0	0.0	0.0
43	20	21	0	0	3.785D 01	5.371D-02	4.457D-02	3.762D-03	1.757D-02	0.0	0.0	0.0	0.0	0.0
44	21	22	0	0	4.129D 01	4.924D-02	4.086D-02	2.897D-03	1.353D-02	0.0	0.0	0.0	0.0	0.0
45	22	23	0	0	6.489D 01	3.133D-02	2.600D-02	7.467D-04	3.488D-03	0.0	0.0	0.0	0.0	0.0
46	3	29	0	1	2.643D 00	2.288D-02	2.288D-02	9.663D-02	2.899D-01	1.818D 00	1.818D 00	0.0	3.813D-01	3.813D-01
47	5	29	0	2	2.643D 00	2.288D-02	2.288D-02	9.663D-02	2.899D-01	1.818D 00	1.818D 00	0.0	3.813D-01	3.813D-01
48	9	29	0	3	2.643D 00	2.288D-02	2.288D-02	9.663D-02	2.899D-01	1.818D 00	1.818D 00	0.0	3.813D-01	3.813D-01
49	11	29	0	4	2.643D 00	2.288D-02	2.288D-02	9.663D-02	2.899D-01	1.818D 00	1.818D 00	0.0	3.813D-01	3.813D-01
50	30	31	0	0	9.811D-01	6.755D-02	5.605D-02	1.072D 00	1.072D 00	0.0	0.0	0.0	0.0	0.0
51	30	32	0	0	1.745D 00	2.414D-01	2.414D-01	4.890D 00	4.890D 00	0.0	0.0	0.0	0.0	0.0
52	5	30	0	0	0.0	1.086D-01	9.009D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	11	30	0	0	0.0	1.086D-01	9.009D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54	29	30	0	0	0.0	3.357D-02	2.786D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	29	30	5	1	0.0	3.357D-02	2.786D-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	14	0	0	0	0.0	1.400D-01	1.400D-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	18	0	0	0	0.0	1.400D-01	1.400D-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0

BEAM UNCOUPLED,UNDAMPED FREQUENCIES (CPS)

IJ	I	J	M	N	(1)	(2)	(3)	(4)	(5)	(6)
1	1	2	0	0	3.4805D 03	7.5602D 02	6.2847D 03	9.7678D 02	3.6631D 03	5.6174D 02
2	2	3	0	0	1.2901D 03	1.2738D 02	1.0589D 03	3.3515D 02	1.1510D 03	1.9506D 02
3	3	4	0	0	1.0767D 03	9.7447D 01	8.1007D 02	2.7221D 02	8.8603D 02	1.5803D 02
4	4	5	0	0	1.4414D 03	1.4232D 02	1.1831D 03	4.0452D 02	1.3614D 03	1.9682D 02
5	5	6	0	0	2.5611D 03	3.9737D 02	3.3033D 03	7.1802D 02	2.5985D 03	3.8915D 02
6	7	8	0	0	1.4046D 03	5.6183D 02	1.5901D 03	1.5489D 02	5.2760D 02	2.8786D 02
7	8	9	0	0	5.2952D 02	9.6276D 01	2.7248D 02	5.6932D 01	1.8133D 02	9.5593D 01
8	9	10	0	0	4.4420D 02	7.4034D 01	2.0953D 02	4.7316D 01	1.4581D 02	8.6028D 01
9	10	11	0	0	5.8240D 02	1.0589D 02	2.9969D 02	6.4207D 01	2.0329D 02	1.0343D 02
10	11	12	0	0	1.0336D 03	2.9531D 02	8.3579D 02	1.1373D 02	3.7903D 02	2.0464D 02
11	1	0	0	0	1.9008D 03	6.6522D 01	1.3966D 03	6.1773D 02	1.6760D 03	1.2280D 02
12	2	0	0	0	1.0631D 03	3.7204D 01	7.8107D 02	3.1091D 02	9.3731D 02	5.8248D 01
13	3	0	0	0	5.5106D 02	1.9285D 01	4.0489D 02	8.4903D 01	2.7657D 02	3.8830D 01
14	4	0	0	0	8.8638D 02	3.1021D 01	6.5126D 02	2.4484D 02	7.8154D 02	4.4733D 01
15	5	0	0	0	1.0020D 03	3.5067D 01	7.3621D 02	2.9222D 02	8.8348D 02	5.4666D 01
16	6	0	0	0	1.6098D 03	5.6339D 01	1.1828D 03	5.0153D 02	1.4174D 03	9.7075D 01
17	1	7	0	0	1.4438D 03	4.8903D 01	6.7417D 02	2.9175D 02	7.9873D 02	9.3045D 01
18	2	8	0	0	8.0793D 02	2.7366D 01	3.7727D 02	1.4793D 02	4.4729D 02	4.2468D 01
19	3	9	0	0	4.3262D 02	1.4653D 01	2.0201D 02	4.7777D 01	1.5473D 02	3.0119D 01
20	4	10	0	0	6.7377D 02	2.2822D 01	3.1462D 02	1.1693D 02	3.7296D 02	3.3898D 01
21	5	11	0	0	7.6155D 02	2.5795D 01	3.5561D 02	1.3906D 02	4.2101D 02	4.1424D 01
22	6	12	0	0	1.2227D 03	4.1416D 01	5.7096D 02	2.3756D 02	6.7559D 02	7.3579D 01
23	7	13	0	0	1.1769D 03	1.4247D 02	2.6985D 01	2.2613D 02	5.2455D 01	2.9089D 02
24	8	14	0	0	5.2359D 02	6.3383D 01	1.2006D 01	7.4407D 01	2.3959D 01	1.2566D 02
25	9	15	0	0	5.2111D 02	6.3083D 01	1.1949D 01	7.1607D 01	2.3403D 01	1.1861D 02
26	10	16	0	0	5.5081D 02	6.6678D 01	1.2630D 01	7.2416D 01	2.4427D 01	1.2456D 02
27	11	17	0	0	9.6306D 02	1.0552D 02	2.1720D 01	6.8734D 01	4.3293D 01	2.0221D 02

28	12	18	0	0	7.9165D 02	9.5834D 01	1.8162D 01	1.3300D 02	3.6187D 01	1.9752D 02
29	17	22	0	0	6.3139D 02	9.1194D 01	1.7274D 01	4.2983D 01	2.9622D 01	1.4028D 02
30	18	23	0	0	1.0108D 03	1.4600D 02	2.7655D 01	1.9923D 02	5.0142D 01	2.2485D 02
31	14	19	0	0	9.9648D 02	[illegible].4393D 02	6.1063D 02	6.1674D 02	1.0524D 03	2.1717D 02
32	19	24	0	0	5.6250D 02	[illegible].0498D 01	5.5424D 01	5.3180D 01	1.1096D 02	2.3601D 01
33	20	25	0	0	5.1096D 02	9.5362D 00	5.0345D 01	5.1395D 01	1.1731D 02	2.4622D 01
34	21	26	0	0	5.1096D 02	9.5362D 00	5.0345D 01	5.1395D 01	1.1731D 02	2.4622D 01
35	22	27	0	0	5.0214D 02	9.3716D 00	4.9477D 01	4.8415D 01	1.0037D 02	2.1212D 01
36	23	28	0	0	8.0304D 02	1.4987D 01	7.9125D 01	8.3596D 01	1.6066D 02	3.5327D 01
37	13	14	0	0	3.0402D 03	3.4614D 03	5.6405D 02	4.2112D 02	2.1465D 02	5.9140D 03
38	14	15	0	0	1.1831D 03	6.1227D 02	9.9773D 01	1.6640D 02	8.0344D 01	1.2449D 03
39	15	16	0	0	1.2010D 03	5.6973D 02	9.2840D 01	1.6369D 02	7.8339D 01	1.1589D 03
40	16	17	0	0	1.1539D 03	5.9719D 02	9.7315D 01	1.6197D 02	7.8112D 01	9.1156D 02
41	17	18	0	0	1.7487D 03	1.4[illegible]21D 03	2.3174D 02	2.5537D 02	1.2738D 02	2.3061D 03
42	19	20	0	0	1.6984D 03	3.9209D 03	1.8142D 03	9.3808D 02	1.8330D 03	3.0186D 03
43	20	21	0	0	1.5915D 03	3.3680D 03	1.5584D 03	1.0013D 03	1.9359D 03	3.1797D 03
44	21	22	0	0	1.5742D 03	3.6342D 03	1.6815D 03	8.8872D 02	1.7308D 03	2.8511D 03
45	22	23	0	0	2.4748D 03	8.9779D 03	4.1541D 03	1.1664D 03	2.4392D 03	3.9473D 03
46	3	29	0	1	3.7625D 02	1.5447D 02	8.9185D 01	1.0597D 02	6.9492D 01	1.2344D 02
47	5	29	0	2	5.6372D 02	2.3349D 02	1.3481D 02	1.4404D 02	1.9044D 02	3.1033D 02
48	9	29	0	3	3.6311D 02	1.5031D 02	8.6781D 01	7.7329D 01	6.4622D 01	1.1454D 02
49	11	29	0	4	5.1710D 02	2.1230D 02	1.2257D 02	9.5198D 01	1.0570D 02	1.7685D 02
50	30	31	0	0	6.1115D 01	8.5914D 00	8.5914D 00	4.6263D 00	9.2062D 00	9.2004D 00
51	30	32	0	0	1.1514D 01	2.1211D 00	2.1211D 00	1.0136D 00	2.2729D 00	2.2714D 00
52	5	30	0	0	4.4468D 01	0.0	0.0	0.0	0.0	0.0
53	11	30	0	0	3 9740D 01	0.0	0.0	0.0	0.0	0.0
54	29	30	0	0	1.8055D 01	0.0	0.0	0.0	0.0	0.0
55	29	30	5	1	3 1640D 01	0.0	0.0	0.0	0.0	0.0
56	14	0	0	0	6.9434D 02	0.0	0.0	0.0	0.0	0.0
57	18	0	0	0	1.0497D 03	0.0	0.0	0.0	0.0	0.0

DAMPING TERMS (LB/IN/SEC,TRANSLATIONS (1)-(3) AND LB-IN-SEC,ROTATIONS (4)-(6))

IJ	I	J	M	N	(1)	(2)	(3)	(4)	(5)	(6)
1	1	2	0	0	3.658260-06	1.684130-05	2.025920-06	1.303510-05	3.475870-06	2.266600-05
2	2	3	0	0	9.869120-06	9.995460-05	1.202400-05	3.799040-05	1.106240-05	6.527350-05
3	3	4	0	0	1.182570-05	1.306590-04	1.571760-05	4.677420-05	1.437010-05	8.057000-05
4	4	5	0	0	8.833370-06	8.946450-05	1.076210-05	3.147510-05	9.352190-06	6.468950-05
5	5	6	0	0	4.971500-06	3.204180-05	3.854460-06	1.773260-05	4.899980-06	3.271850-05
6	7	8	0	0	9.064960-06	2.266230-05	8.007360-06	8.220220-05	2.413260-05	4.423120-05
7	8	9	0	0	2.404540-05	1.322490-04	4.672810-05	2.236440-04	7.021830-05	1.331930-04
8	9	10	0	0	2.866360-05	1.719810-04	6.076680-05	2.690940-04	8.731950-05	1.480020-04
9	10	11	0	0	2.186210-05	1.202410-04	4.248530-05	1.983010-04	6.263140-05	1.230960-04
10	11	12	0	0	1.231860-05	4.311500-05	1.523400-05	1.119560-04	3.359220-05	6.221710-05
11	1	0	0	0	6.698510-06	1.914020-04	9.116820-06	2.061160-05	7.597110-06	1.036810-04
12	2	0	0	0	1.197720-05	3.422340-04	1.630120-05	4.095140-05	1.358400-05	2.185910-04
13	3	0	0	0	2.310530-05	6.602070-04	3.144680-05	1.499630-04	4.603640-05	3.279020-04
14	4	0	0	0	1.436440-05	4.104470-04	1.955030-05	5.200290-05	1.629140-05	2.846300-04
15	5	0	0	0	1.270700-05	3.630850-04	1.729440-05	4.357100-05	1.441160-05	2.329120-04
16	6	0	0	0	7.909240-06	2.259970-04	1.076460-05	2.538730-05	8.983050-06	1.311610-04
17	1	7	0	0	8.818840-06	2.603630-04	1.888600-05	4.364090-05	1.594070-05	1.368420-04
18	2	8	0	0	1.575920-05	4.652660-04	3.374920-05	8.607260-05	2.846550-05	2.998140-04
19	3	9	0	0	2.943110-05	8.689090-04	6.302840-05	2.664960-04	8.228530-05	4.227320-04
20	4	10	0	0	1.889710-05	5.579080-04	4.046920-05	1.088930-04	3.413840-05	3.756110-04
21	5	11	0	0	1.671900-05	4.936030-04	3.580460-05	9.155910-05	3.024280-05	3.073710-04
22	6	12	0	0	1.041300-05	3.074280-04	2.230000-05	5.359700-05	1.884640-05	1.730450-04
23	7	13	0	0	1.081890-05	8.937150-05	4.718290-04	5.630620-05	2.427320-04	4.377050-05
24	8	14	0	0	2.431750-05	2.008800-04	1.060530-03	1.711190-04	5.314340-04	1.013280-04
25	9	15	0	0	2.443310-05	2.018350-04	1.065570-03	1.778090-04	5.440400-04	1.073430-04
26	10	16	0	0	2.311570-05	1.909520-04	1.008110-03	1.758240-04	5.212480-04	1.022170-04
27	11	17	0	0	1.322080-05	1.206660-04	5.861990-04	1.852410-04	2.940990-04	6.296570-05

28	12	18	0	0	1.608330-05	1.328590-04	7.014180-04	9.573350-05	3.518540-04	6.446230-05
29	17	22	0	0	2.016570-05	1.396190-04	7.371040-04	2.962200-04	4.298320-04	9.076600-05
30	18	23	0	0	1.259580-05	8.720800-05	4.604070-04	6.390750-05	2.539290-04	5.662670-05
31	14	19	0	0	1.277740-05	8.846510-05	2.084460-05	2.064480-05	1.209800-05	5.862990-05
32	19	24	0	0	2.263530-05	1.212820-03	2.297260-04	2.394210-04	1.147450-04	5.394830-04
33	20	25	0	0	2.491880-05	1.335170-03	2.529010-04	2.477370-04	1.085380-04	5.171130-04
34	21	26	0	0	2.491880-05	1.335170-03	2.529010-04	2.477370-04	1.085380-04	5.171130-04
35	22	27	0	0	2.535630-05	1.358610-03	2.573420-04	2.629830-04	1.268590-04	6.002500-04
36	23	28	0	0	1.585520-05	8.495360-04	1.609150-04	1.523090-04	7.925220-05	3.604140-04
37	13	14	0	0	4.188050-06	3.678440-06	2.257330-05	3.023470-05	5.931780-05	2.152910-06
38	14	15	0	0	1.076200-05	2.079530-05	1.276130-04	7.651860-05	1.584740-04	1.022760-05
39	15	16	0	0	1.060180-05	2.234810-05	1.371430-04	7.778490-05	1.625300-04	1.098660-05
40	16	17	0	0	1.103380-05	2.132050-05	1.308360-04	7.860850-05	1.630010-04	1.396760-05
41	17	18	0	0	7.281020-06	8.953070-06	5.494180-05	4.985810-05	9.995680-05	5.521250-06
42	19	20	0	0	7.496690-06	3.24[illegible]300-06	7.018150-06	1.357280-05	6.946240-06	4.218020-06
43	20	21	0	0	8.000070-06	3.780380-06	8.170250-06	1.271550-05	6.577030-06	4.004310-06
44	21	22	0	0	8.088210-06	3.503530-06	7.571910-06	1.432670-05	7.356160-06	4.465810-06
45	22	23	0	0	5.144890-06	1.418190-06	3.065030-06	1.091560-05	5.219980-06	3.225610-06
46	3	29	0	1	3.384010-05	8.242510-05	1.427650-04	1.201470-04	1.832210-04	1.031440-04
47	5	29	0	2	2.238790-05	5.453060-05	9.444970-05	8.839220-05	6.685780-05	4.102820-05
48	9	29	0	3	3.477740-05	8.470790-05	1.467180-04	1.646530-04	1.970300-04	1.111610-04
49	11	29	0	4	2.462280-05	5.997420-05	1.038780-04	1.337460-04	1.204580-04	7.199610-05
50	30	31	0	0	2.135430-03	1.519030-02	1.519030-02	2.821000-02	1.417600-02	1.418500-02
51	30	32	0	0	8.753550-03	4.669020-02	4.669020-02	9.770930-02	4.357240-02	4.360010-02
52	5	30	0	0	2.863260-04	0.0	0.0	0.0	0.0	0.0
53	11	30	0	0	3.203920-04	0.0	0.0	0.0	0.0	0.0
54	29	30	0	0	7.051980-04	0.0	0.0	0.0	0.0	0.0
55	29	30	5	1	4.024210-04	0.0	0.0	0.0	0.0	0.0
56	14	0	0	0	1.833740-05	0.0	0.0	0.0	0.0	0.0
57	18	0	0	0	1.212900-05	0.0	0.0	0.0	0.0	0.0

EULER ANGLES, BEAM IJ TO AIRPLANE (RADIANS)

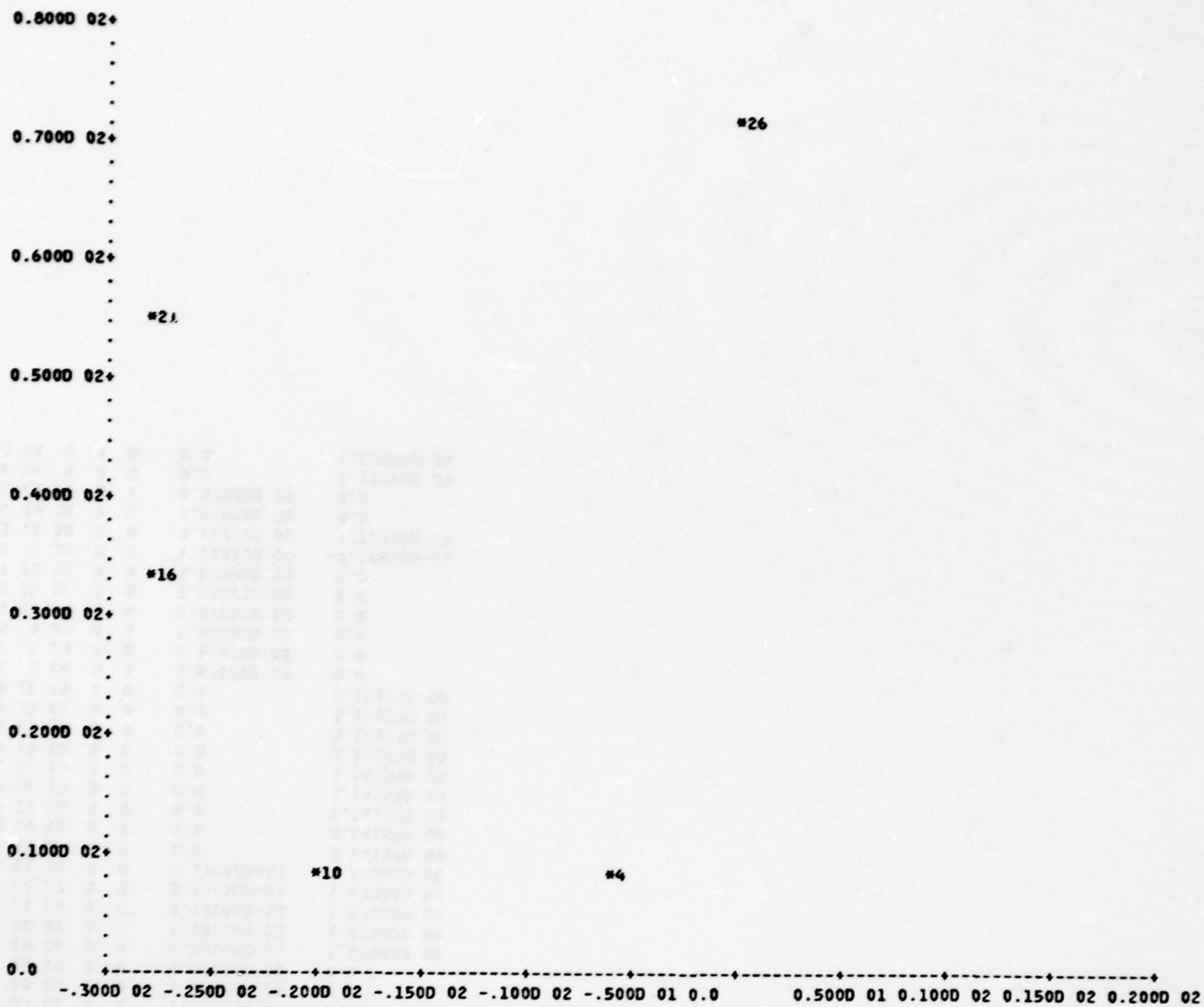
IJ	I	J	M	N	THEIJO(IJ)	PSIIJO(IJ)
1	1	2	0	0	0.0	3.141590 00
2	2	3	0	0	0.0	3.141590 00
3	3	4	0	0	0.0	3.141590 00
4	4	5	0	0	0.0	3.141590 00
5	5	6	0	0	0.0	3.141590 00
6	7	8	0	0	0.0	3.141590 00
7	8	9	0	0	0.0	3.141590 00
8	9	10	0	0	0.0	3.141590 00
9	10	11	0	0	0.0	3.141590 00
10	11	12	0	0	0.0	3.141590 00
11	1	0	0	0	0.0	1.570800 00
12	2	0	0	0	0.0	1.570800 00
13	3	0	0	0	0.0	1.570800 00
14	4	0	0	0	0.0	1.570800 00
15	5	0	0	0	0.0	1.570800 00
16	6	0	0	0	0.0	1.570800 00
17	1	7	0	0	0.0	-1.570800 00
18	2	8	0	0	0.0	-1.570800 00
19	3	9	0	0	0.0	-1.570800 00
20	4	10	0	0	0.0	-1.570800 00
21	5	11	0	0	0.0	-1.570800 00
22	6	12	0	0	0.0	-1.570800 00
23	7	13	0	0	1.261090 00	-1.570800 00
24	8	14	0	0	1.261090 00	-1.570800 00
25	9	15	0	0	1.261090 00	-1.570800 00
26	10	16	0	0	1.261090 00	-1.570800 00
27	11	17	0	0	1.261090 00	-1.570800 00

28	12	18	0	0	1.261090 00	-1.570800 00
29	17	22	0	0	1.570800 00	0.0
30	18	23	0	0	1.570800 00	0.0
31	14	19	0	0	1.570800 00	0.0
32	19	24	0	0	5.191460-01	1.570800 00
33	20	25	0	0	5.191460-01	1.570800 00
34	21	26	0	0	5.191460-01	1.570800 00
35	22	27	0	0	5.191460-01	1.570800 00
36	23	28	0	0	5.191460-01	1.570800 00
37	13	14	0	0	0.0	3.141590 00
38	14	15	0	0	0.0	3.141590 00
39	15	16	0	0	0.0	3.141590 00
40	16	17	0	0	0.0	3.141590 00
41	17	18	0	0	0.0	3.141590 00
42	19	20	0	0	0.0	3.141590 00
43	20	21	0	0	0.0	3.141590 00
44	21	22	0	0	0.0	3.141590 00
45	22	23	0	0	0.0	3.141590 00
46	3	29	0	1	1.570800 00	0.0
47	5	29	0	2	1.570800 00	0.0
48	9	29	0	3	1.570800 00	0.0
49	11	29	0	4	1.570800 00	0.0
50	30	31	0	0	1.570800 00	0.0
51	30	32	0	0	1.570800 00	0.0
52	5	30	0	0	1.117100 00	-7.188300-01
53	11	30	0	0	1.117100 00	7.188300-01
54	29	30	0	0	1.570800 00	0.0
55	29	30	5	1	1.570800 00	0.0
56	14	0	0	0	0.0	1.570800 00
57	18	0	0	0	0.0	1.570800 00

TIME = 0

MASS POSITION PLOT PLANE ** Y(+RIGHT) - Z(+UP)
NOTE *** A MODIFIED RIGHT HAND GROUND COORDINATE SYSTEM HAS BEEN USED FOR THIS PLOT ***

MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS
4	-6.00	8.2	10	-20.00	8.24	16	-28.00	33.23	21	-28.00	55.23
26	0.0	71.23									

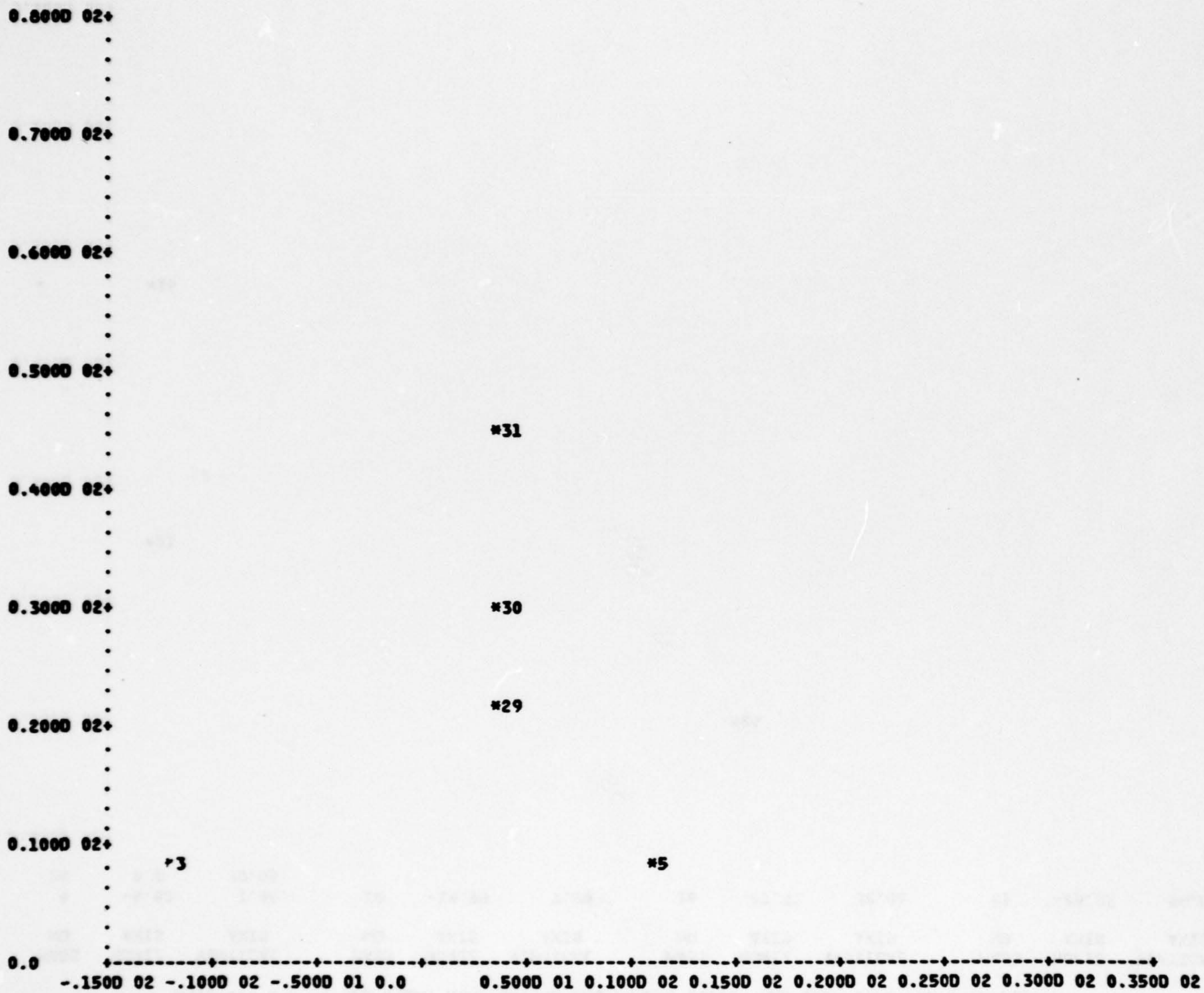


TIME = 0

MASS POSITION PLOT PLANE ** X(+AFT) - Z(+UP)

NOTE *** A MODIFIED RIGHT HAND GROUND COORDINATE SYSTEM HAS BEEN USED FOR THIS PLOT ***

MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS
3	-11.84	8.39	5	11.16	8.09	29	3.35	22.50	30	3.45	29.99
31	3.64	45.08									

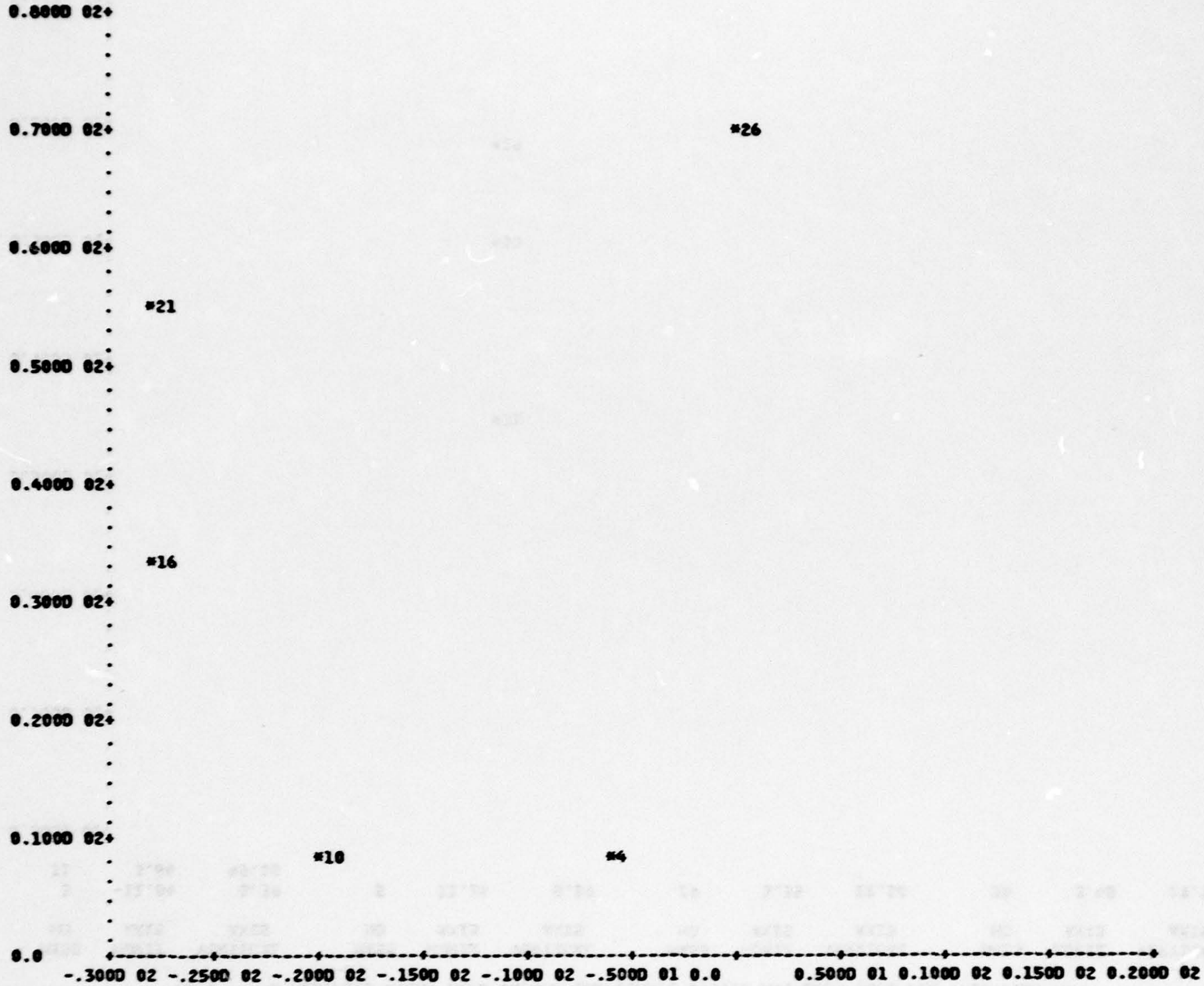


TIME = 0.054

MASS POSITION PLOT PLANE ** Y(+RIGHT) - Z(+UP)

NOTE *** A MODIFIED RIGHT HAND GROUND COORDINATE SYSTEM HAS BEEN USED FOR THIS PLOT ***

MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS
4	-6.00	7.88	10	-19.99	7.80	16	-27.91	32.81	21	-28.05	54.82
26	0.0	70.65									

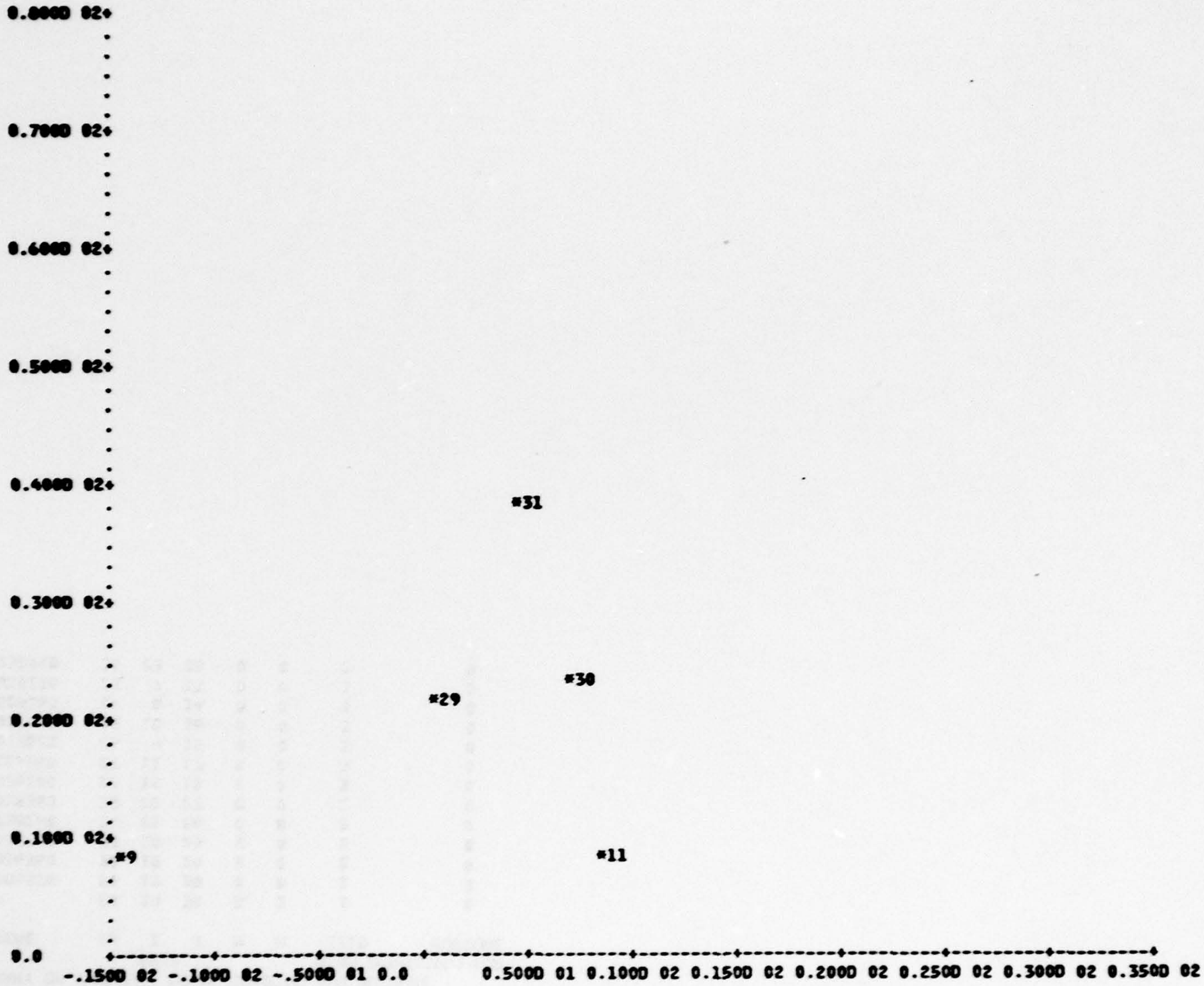


MASS POSITION PLOT PLANE ** X(+AFT) - Z(+UP)

TIME = 0.064

NOTE *** A MODIFIED RIGHT HAND GROUND COORDINATE SYSTEM HAS BEEN USED FOR THIS PLOT ***

MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS	MASS NO	HORIZ AXIS	VERTICAL AXIS
9	-14.66	7.03	11	0.33	7.75	29	0.35	22.12	30	7.24	23.03
31	4.62	37.05									



SUMMARY OF INTERNAL BEAM YIELDING AND RUPTURE

TIME	BEAM IJ	I	J	M	N	BEAM DIRECTION FOR YIELD	RUPTURE
0.0	55	29	30	5	1	1	0
0.006870	54	29	30	0	0	1	0
0.016960	32	19	24	0	0	2	0
0.017310	33	20	25	0	0	2	0
0.018260	34	21	26	0	0	2	0
0.019360	35	22	27	0	0	2	0
0.026100	28	12	18	0	0	3	0
0.026860	27	11	17	0	0	3	0
0.027620	25	9	15	0	0	3	0
0.027650	26	10	16	0	0	3	0
0.028260	24	8	14	0	0	3	0
0.029190	23	7	13	0	0	3	0
0.032440	36	23	28	0	0	2	0

SUMMARY O' ENERGY DISTRIBUTION

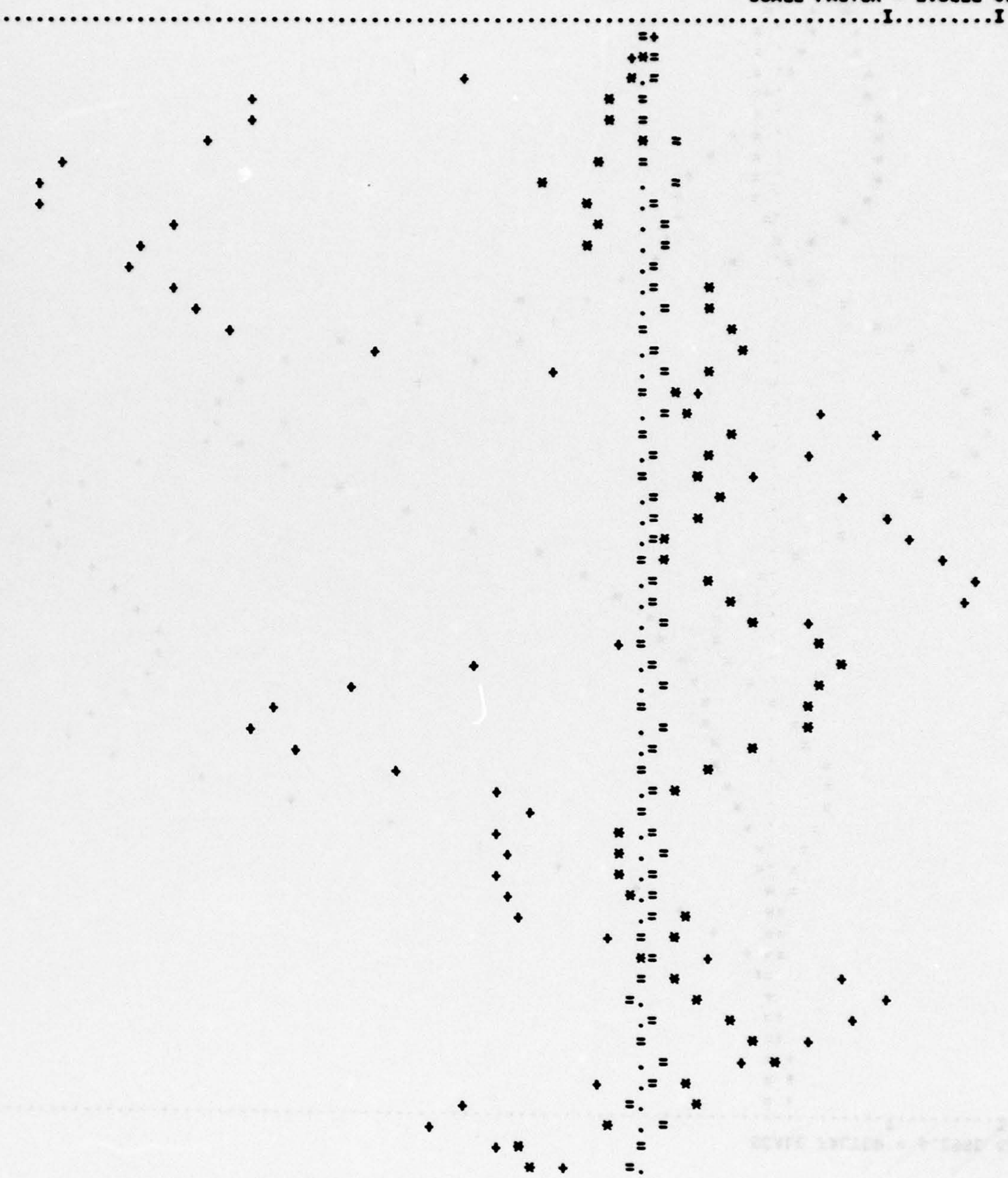
TIME	PERCENT MAXIMUM ENERGY DEVIATION	PERCENT TOTAL SYSTEM ENERGY	KINETIC ENERGY	PERCENT OF CURRENT TOTAL	POTENTIAL ENERGY	PERCENT OF CURRENT TOTAL	STRAIN ENERGY	PERCENT OF CURRENT TOTAL	DAMPING ENERGY	PERCENT OF CURRENT TOTAL	CRUSHING ENERGY	PERCENT OF CURRENT TOTAL	FRICTION ENERGY	PERCENT OF CURRENT TOTAL
.0	0.0	100.00	7.669E 04	82.67	1.607E 04	17.33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
.00100	0.253424	100.02	7.495E 04	80.79	1.589E 04	17.13	1.257E 02	0.14	9.968E 00	0.01	1.797E 03	1.94	0.0	0.0
.00200	0.368142	100.04	6.998E 04	75.41	1.572E 04	16.94	3.005E 02	0.32	4.003E 01	0.04	6.757E 03	7.28	0.0	0.0
.00300	0.279686	100.04	6.413E 04	69.11	1.555E 04	16.76	7.714E 02	0.83	7.385E 01	0.08	1.227E 04	13.22	0.0	0.0
.00400	0.281395	100.04	5.911E 04	63.70	1.540E 04	16.59	1.049E 03	1.13	1.115E 02	0.12	1.713E 04	18.46	0.0	0.0
.00500	0.511445	100.03	5.464E 04	58.89	1.525E 04	16.43	1.944E 03	2.09	1.487E 02	0.16	2.081E 04	22.43	0.0	0.0
.00600	0.640265	100.03	5.075E 04	54.70	1.511E 04	16.28	2.959E 03	3.19	1.938E 02	0.21	2.378E 04	25.63	0.0	0.0
.00700	0.677775	100.03	4.728E 04	50.95	1.498E 04	16.14	4.378E 03	4.72	2.365E 02	0.25	2.592E 04	27.93	0.0	0.0
.00800	0.747329	100.03	4.436E 04	47.83	1.486E 04	16.01	5.656E 03	6.09	2.716E 02	0.29	2.763E 04	29.77	0.0	0.0
.00900	0.833982	100.03	4.203E 04	45.29	1.474E 04	15.89	7.029E 03	7.58	3.000E 02	0.32	2.869E 04	30.92	0.0	0.0
.01000	0.959331	100.03	4.035E 04	43.49	1.464E 04	15.78	8.178E 03	8.81	3.208E 02	0.35	2.930E 04	31.58	0.0	0.0
.01100	0.881527	100.03	3.913E 04	42.17	1.454E 04	15.67	9.187E 03	9.90	3.422E 02	0.37	2.959E 04	31.89	0.0	0.0
.01200	0.875477	100.04	3.813E 04	41.09	1.446E 04	15.58	1.013E 04	10.92	3.726E 02	0.40	2.970E 04	32.01	0.0	0.0
.01300	0.833560	100.04	3.712E 04	40.00	1.438E 04	15.49	1.121E 04	12.08	4.201E 02	0.45	2.968E 04	31.98	0.0	0.0
.01400	0.830895	100.04	3.572E 04	38.49	1.430E 04	15.41	1.274E 04	13.72	4.956E 02	0.53	2.955E 04	31.84	0.0	0.0
.01500	0.813562	100.05	3.359E 04	36.19	1.423E 04	15.34	1.502E 04	16.18	5.923E 02	0.64	2.938E 04	31.65	0.0	0.0
.01600	0.808676	100.06	3.046E 04	32.82	1.417E 04	15.27	1.826E 04	19.67	7.098E 02	0.76	2.922E 04	31.48	0.0	0.0
.01700	0.799835	100.06	2.664E 04	28.70	1.411E 04	15.21	2.211E 04	23.82	8.245E 02	0.89	2.913E 04	31.39	0.0	0.0
.01800	0.744471	100.07	2.276E 04	24.52	1.406E 04	15.15	2.596E 04	27.96	9.260E 02	1.00	2.912E 04	31.37	0.0	0.0
.01900	0.686459	100.07	1.904E 04	20.51	1.401E 04	15.09	2.970E 04	31.99	1.001E 03	1.08	2.908E 04	31.33	0.0	0.0
.02000	0.717363	100.07	1.577E 04	16.99	1.396E 04	15.04	3.308E 04	35.63	1.043E 03	1.12	2.898E 04	31.22	0.0	0.0
.02100	0.647712	100.08	1.312E 04	14.14	1.392E 04	14.99	3.582E 04	38.58	1.074E 03	1.16	2.891E 04	31.14	0.0	0.0
.02200	0.673277	100.08	1.109E 04	11.94	1.387E 04	14.94	3.788E 04	40.80	1.108E 03	1.19	2.889E 04	31.12	0.0	0.0
.02300	0.678491	100.09	9.529E 03	10.26	1.382E 04	14.89	3.943E 04	42.47	1.150E 03	1.24	2.890E 04	31.13	0.0	0.0
.02400	0.709935	100.09	8.309E 03	8.95	1.378E 04	14.84	4.064E 04	43.77	1.191E 03	1.28	2.892E 04	31.15	0.0	0.0
.02500	0.830267	100.09	7.525E 03	8.10	1.374E 04	14.79	4.137E 04	44.56	1.238E 03	1.33	2.897E 04	31.21	0.0	0.0
.02600	0.934466	100.10	7.009E 03	7.55	1.369E 04	14.75	4.181E 04	45.02	1.295E 03	1.39	2.905E 04	31.28	0.0	0.0
.02700	0.922010	100.10	6.626E 03	7.14	1.365E 04	14.70	4.204E 04	45.27	1.359E 03	1.46	2.918E 04	31.42	0.0	0.0
.02800	0.918876	100.10	6.336E 03	6.82	1.362E 04	14.66	4.210E 04	45.34	1.424E 03	1.53	2.938E 04	31.64	0.0	0.0
.02900	0.961489	100.11	5.885E 03	6.34	1.359E 04	14.63	4.213E 04	45.36	1.493E 03	1.61	2.977E 04	32.06	0.0	0.0
.03000	1.017785	100.11	5.315E 03	5.72	1.356E 04	14.60	4.219E 04	45.43	1.567E 03	1.69	3.023E 04	32.56	0.0	0.0
.03100	1.050775	100.11	5.087E 03	5.48	1.354E 04	14.58	4.207E 04	45.30	1.645E 03	1.77	3.052E 04	32.87	0.0	0.0
.03200	1.076124	100.11	5.290E 03	5.70	1.353E 04	14.57	4.175E 04	44.96	1.735E 03	1.87	3.055E 04	32.90	0.0	0.0
.03300	1.094804	100.11	6.030E 03	6.49	1.353E 04	14.57	4.109E 04	44.25	1.839E 03	1.98	3.037E 04	32.71	0.0	0.0
.03400	1.101387	100.11	7.232E 03	7.79	1.353E 04	14.57	4.000E 04	43.07	1.963E 03	2.11	3.014E 04	32.46	0.0	0.0
.03500	1.113096	100.12	8.817E 03	9.49	1.354E 04	14.58	3.845E 04	41.40	2.101E 03	2.26	2.996E 04	32.26	0.0	0.0
.03600	1.115771	100.12	1.058E 04	11.39	1.355E 04	14.59	3.659E 04	39.40	2.249E 03	2.42	2.990E 04	32.20	0.0	0.0
.03700	1.126314	100.13	1.227E 04	13.21	1.356E 04	14.60	3.475E 04	37.42	2.404E 03	2.59	2.989E 04	32.18	0.0	0.0
.03800	1.143449	100.13	1.348E 04	14.52	1.358E 04	14.62	3.339E 04	35.95	2.566E 03	2.76	2.987E 04	32.16	0.0	0.0
.03900	1.151624	100.14	1.388E 04	14.95	1.360E 04	14.64	3.288E 04	35.40	2.718E 03	2.93	2.981E 04	32.09	0.0	0.0
.04000	1.168576	100.14	1.362E 04	14.67	1.361E 04	14.66	3.304E 04	35.57	2.842E 03	3.06	2.977E 04	32.05	0.0	0.0
.04100	1.217560	100.15	1.334E 04	14.36	1.363E 04	14.68	3.324E 04	35.78	2.939E 03	3.16	2.975E 04	32.02	0.0	0.0
.04200	1.237304	100.15	1.315E 04	14.16	1.365E 04	14.70	3.334E 04	35.88	3.024E 03	3.25	2.973E 04	32.01	0.0	0.0
.04300	1.258885	100.16	1.292E 04	13.90	1.368E 04	14.72	3.348E 04	36.04	3.097E 03	3.33	2.973E 04	32.00	0.0	0.0
.04400	2.452375	100.17	1.251E 04	13.46	1.370E 04	14.74	3.382E 04	36.40	3.165E 03	3.41	2.973E 04	32.00	0.0	0.0
.04500	3.917643	100.18	1.227E 04	13.20	1.372E 04	14.76	3.398E 04	36.57	3.231E 03	3.48	2.973E 04	31.99	0.0	0.0
.04600	4.318353	100.19	1.235E 04	13.29	1.374E 04	14.78	3.383E 04	36.40	3.299E 03	3.55	2.973E 04	31.99	0.0	0.0
.04700	5.195271	100.21	1.246E 04	13.40	1.375E 04	14.80	3.363E 04	36.18	3.380E 03	3.64	2.973E 04	31.98	0.0	0.0
.04800	5.426345	100.22	1.254E 04	13.49	1.377E 04	14.82	3.346E 04	35.99	3.458E 03	3.72	2.973E 04	31.98	0.0	0.0

.04900	5.568901	[illegible]	1.226E 04	13.19	1.379E 04	14.84	3.365E 04	36.19	3.539E 03	3.81	2.973E 04	31.98	0.0	0.0
.05000	5.996435	100.23	1.173E 04	12.61	1.381E 04	14.86	3.409E 04	36.66	3.619E 03	3.89	2.973E 04	31.98	0.0	0.0
.05100	6.181212	100.24	1.141E 04	12.28	1.383E 04	14.87	3.433E 04	36.92	3.680E 03	3.96	2.973E 04	31.97	0.0	0.0
.05200	6.342592	100.25	1.154E 04	12.41	1.385E 04	14.89	3.415E 04	36.72	3.728E 03	4.01	2.973E 04	31.97	0.0	0.0
.05300	6.348572	100.25	1.183E 04	12.72	1.387E 04	14.91	3.378E 04	36.32	3.787E 03	4.07	2.973E 04	31.97	0.0	0.0
.05400	6.358683	100.26	1.202E 04	12.92	1.389E 04	14.93	3.351E 04	36.03	3.859E 03	4.15	2.973E 04	31.97	0.0	0.0

MASS 10 FILTERED ACCELERATION(G'S)

SCALE FACTOR = 1.822E 01

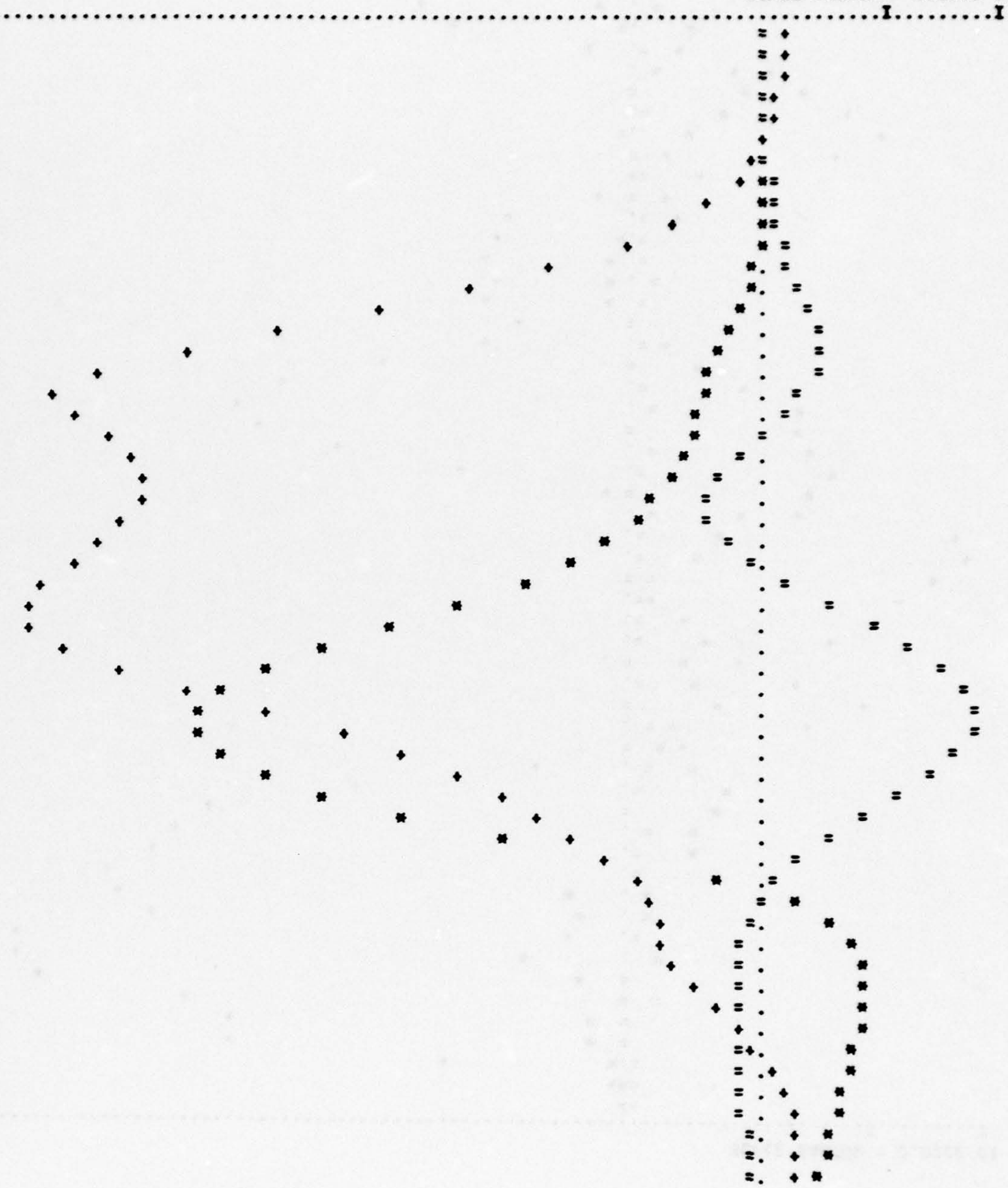
TIME(SEC)	XACCF *	YACCF =	ZACCF +
0.0	-1.310E-02	0.0	9.999E-01
0.001	6.035E-02	2.465E-01	-2.620E 00
0.002	-2.392E 00	1.447E 00	-3.013E 01
0.003	-5.835E 00	-5.489E-01	-6.451E 01
0.004	-6.954E 00	-8.188E-01	-6.419E 01
0.005	-9.469E-01	3.939E 00	-7.268E 01
0.006	-8.668E 00	-8.271E-02	-9.649E 01
0.007	-1.748E 01	4.203E 00	-9.922E 01
0.008	-9.377E 00	1.111E 00	-9.892E 01
0.009	-7.232E 00	2.205E 00	-7.696E 01
0.010	-1.032E 01	2.925E 00	-8.349E 01
0.011	9.941E-01	1.072E 00	-8.424E 01
0.012	1.088E 01	1.006E 00	-7.802E 01
0.013	9.819E 00	3.385E 00	-7.424E 01
0.014	1.364E 01	-3.334E-02	-6.836E 01
0.015	1.510E 01	1.764E 00	-4.492E 01
0.016	9.418E 00	1.923E 00	-1.506E 01
0.017	4.194E 00	-3.580E-01	8.785E 00
0.018	5.997E 00	2.157E 00	2.855E 01
0.019	1.314E 01	-1.954E-01	3.713E 01
0.020	9.334E 00	1.734E 00	2.741E 01
0.021	7.837E 00	-7.225E-01	1.753E 01
0.022	1.212E 01	5.158E-01	3.209E 01
0.023	[illegible].061E 00	9.279E-01	4.017E 01
0.024	3.210E 00	1.337E-01	4.278E 01
0.025	3.518E 00	-1.905E-01	4.889E 01
0.026	1.001E 01	8.310E-01	5.384E 01
0.027	1.338E 01	6.145E-01	5.131E 01
0.028	1.683E 01	2.001E 00	2.584E 01
0.029	2.778E 01	-6.908E-01	-3.942E 00
0.030	3.272E 01	6.719E-01	-2.785E 01
0.031	2.766E 01	2.873E 00	-4.855E 01
0.032	2.655E 01	-4.491E-01	-6.094E 01
0.033	2.732E 01	2.846E 00	-6.378E 01
0.034	1.817E 01	1.029E 00	-5.789E 01
0.035	1.026E 01	-7.422E-01	-4.041E 01
0.036	5.515E 00	1.483E 00	-2.415E 01
0.037	-9.549E-01	-4.866E-01	-1.972E 01
0.038	-5.112E 00	6.273E-01	-2.503E 01
0.039	-4.953E 00	1.994E 00	-2.327E 01
0.040	-4.082E 00	1.889E-01	-2.450E 01
0.041	-2.530E 00	1.630E-01	-2.190E 01
0.042	5.941E 00	1.649E 00	-2.049E 01
0.043	4.165E 00	-8.721E-01	-6.031E 00
0.044	-2.429E-01	1.672E 00	1.077E 01
0.045	4.602E 00	-3.081E-01	3.184E 01
0.046	7.883E 00	-2.654E 00	3.922E 01
0.047	1.405E 01	1.746E 00	3.447E 01
0.048	1.680E 01	-1.265E 00	2.583E 01
0.049	2.111E 01	2.591E 00	1.631E 01
0.050	6.513E 00	1.624E 00	-7.674E 00
0.051	7.453E 00	-1.933E 00	-2.914E 01
0.052	-5.733E 00	2.244E 00	-3.608E 01
0.053	-2.129E 01	-5.006E-01	-2.487E 01
0.054	-1.939E 01	-1.871E 00	-1.397E 01



MASS 30 FILTERED ACCELERATION(G'S)

SCALE FACTOR = 6.299E 00

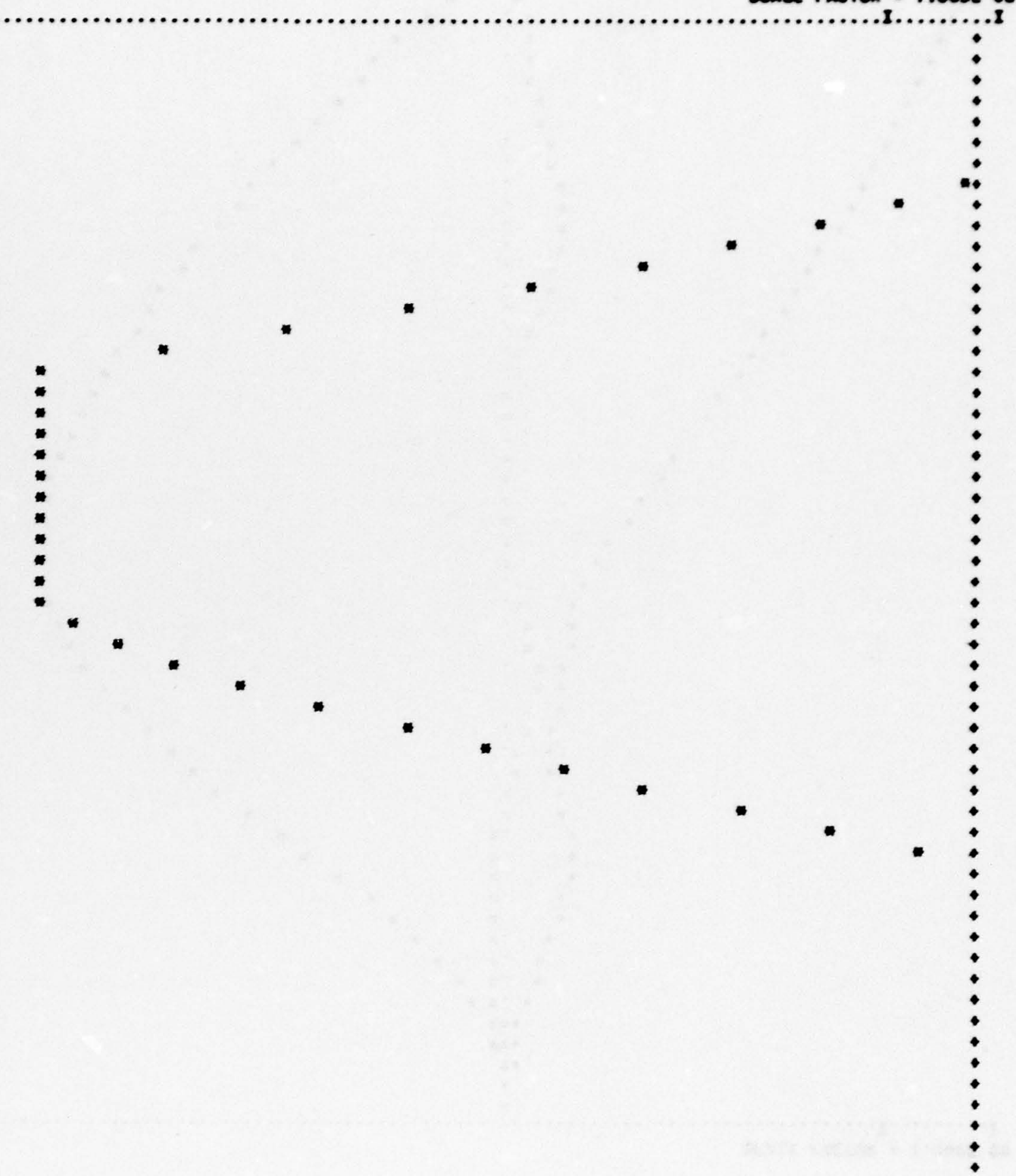
TIME(SEC)	XACCF *	YACCF =	ZACCF +
0.0	-1.310E-02	0.0	9.999E-01
0.001	-1.311E-02	-5.990E-06	9.947E-01
0.002	-1.313E-02	3.588E-05	9.741E-01
0.003	-1.369E-02	8.603E-04	7.193E-01
0.004	-1.694E-02	6.017E-03	3.690E-01
0.005	-2.690E-02	2.240E-02	-1.373E-01
0.006	-4.502E-02	5.700E-02	-7.892E-01
0.007	-7.205E-02	1.185E-01	-1.585E 00
0.008	-1.284E-01	2.462E-01	-3.046E 00
0.009	-2.315E-01	4.663E-01	-5.170E 00
0.010	-3.952E-01	7.995E-01	-7.958E 00
0.011	-6.607E-01	1.286E 00	-1.195E 01
0.012	-1.050E 00	1.659E 00	-1.669E 01
0.013	-1.559E 00	2.414E 00	-2.180E 01
0.014	-2.126E 00	2.832E 00	-2.707E 01
0.015	-2.666E 00	2.985E 00	-3.235E 01
0.016	-3.159E 00	2.742E 00	-3.755E 01
0.017	-3.478E 00	1.991E 00	-3.968E 01
0.018	-3.697E 00	9.064E-01	-3.880E 01
0.019	-4.064E 00	-3.380E-01	-3.701E 01
0.020	-4.604E 00	-1.625E 00	-3.547E 01
0.021	-5.287E 00	-2.735E 00	-3.472E 01
0.022	-6.189E 00	-3.364E 00	-3.488E 01
0.023	-7.405E 00	-3.274E 00	-3.582E 01
0.024	-8.979E 00	-2.400E 00	-3.725E 01
0.025	-1.096E 01	-8.331E-01	-3.883E 01
0.026	-1.355E 01	1.245E 00	-4.023E 01
0.027	-1.693E 01	3.573E 00	-4.114E 01
0.028	-2.089E 01	5.906E 00	-4.084E 01
0.029	-2.480E 01	8.056E 00	-3.905E 01
0.030	-2.805E 01	9.863E 00	-3.598E 01
0.031	-3.035E 01	1.117E 01	-3.214E 01
0.032	-3.151E 01	1.177E 01	-2.792E 01
0.033	-3.141E 01	1.158E 01	-2.381E 01
0.034	-3.015E 01	1.075E 01	-2.025E 01
0.035	-2.785E 01	9.405E 00	-1.735E 01
0.036	-2.451E 01	7.672E 00	-1.491E 01
0.037	-2.016E 01	5.712E 00	-1.270E 01
0.038	-1.486E 01	3.729E 00	-1.063E 01
0.039	-8.885E 00	1.928E 00	-8.716E 00
0.040	-2.672E 00	4.415E-01	-7.010E 00
0.041	1.520E 00	-5.089E-01	-6.295E 00
0.042	3.866E 00	-1.054E 00	-6.032E 00
0.043	5.094E 00	-1.350E 00	-5.670E 00
0.044	5.641E 00	-1.491E 00	-5.007E 00
0.045	5.771E 00	-1.535E 00	-4.043E 00
0.046	5.652E 00	-1.519E 00	-2.882E 00
0.047	5.390E 00	-1.467E 00	-1.663E 00
0.048	5.053E 00	-1.397E 00	-5.180E-01
0.049	4.686E 00	-1.319E 00	4.517E-01
0.050	4.317E 00	-1.240E 00	1.185E 00
0.051	3.960E 00	-1.164E 00	1.663E 00
0.052	3.624E 00	-1.093E 00	1.898E 00
0.053	3.308E 00	-1.027E 00	1.930E 00
0.054	3.012E 00	-9.655E-01	1.809E 00



BEAM 55 I,M = 29, 5 J,N = 30, 1 AXIAL AND SHEAR FORCES(LB)

SCALE FACTOR = 7.685E 02

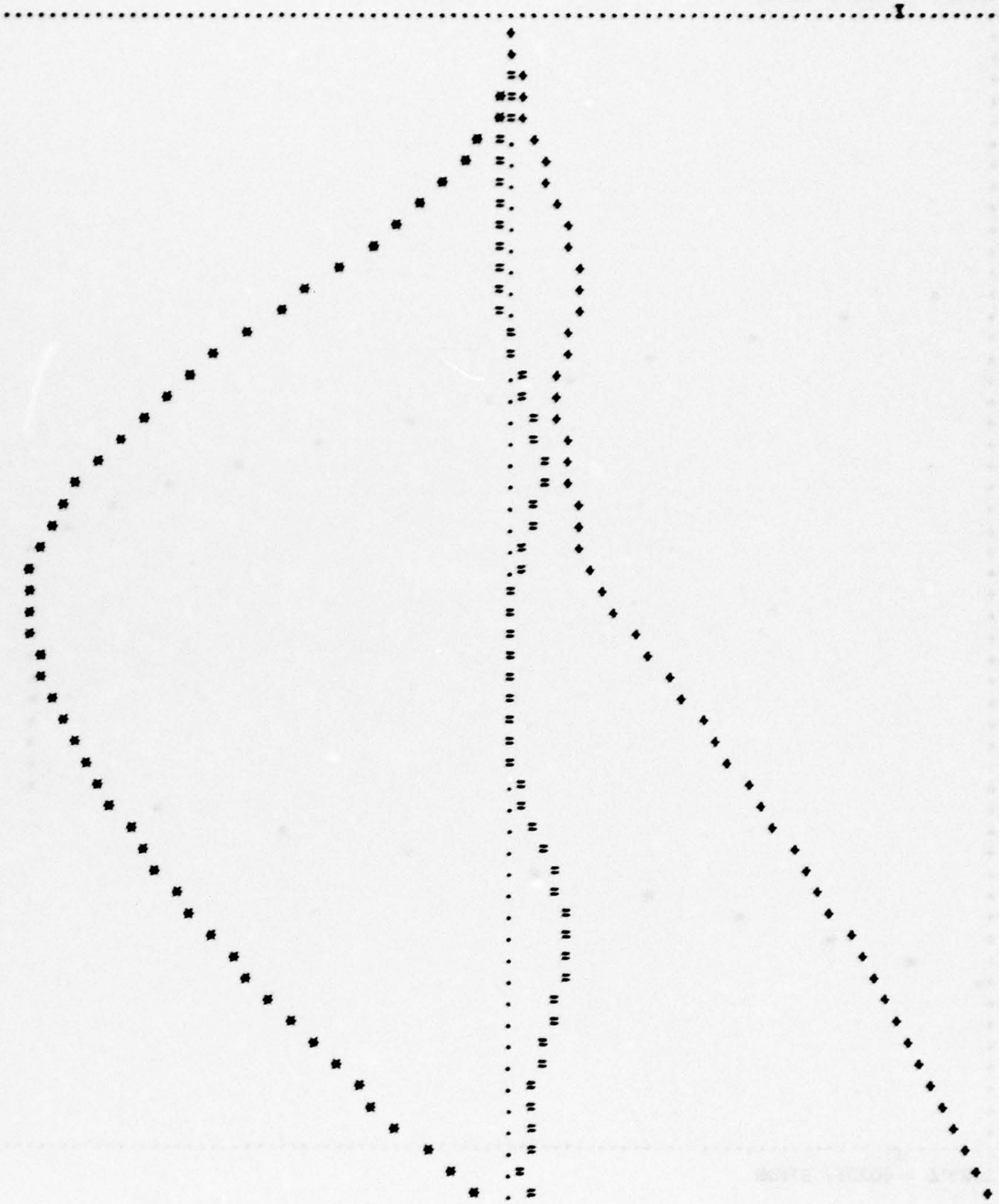
TIME(SEC)	FX *	FY =	FZ +
0.0	0.0	0.0	0.0
0.001	-4.533E-02	0.0	0.0
0.002	-2.554E-01	0.0	0.0
0.003	-6.141E-01	0.0	0.0
0.004	-1.198E 00	0.0	0.0
0.005	-1.945E 00	0.0	0.0
0.006	-2.928E 00	0.0	0.0
0.007	-6.282E 01	0.0	0.0
0.008	-5.206E 02	0.0	0.0
0.009	-1.045E 03	0.0	0.0
0.010	-1.657E 03	0.0	0.0
0.011	-2.338E 03	0.0	0.0
0.012	-3.086E 03	0.0	0.0
0.013	-3.896E 03	0.0	0.0
0.014	-4.746E 03	0.0	0.0
0.015	-5.630E 03	0.0	0.0
0.016	-6.455E 03	0.0	0.0
0.017	-6.455E 03	0.0	0.0
0.018	-6.455E 03	0.0	0.0
0.019	-6.455E 03	0.0	0.0
0.020	-6.455E 03	0.0	0.0
0.021	-6.455E 03	0.0	0.0
0.022	-6.455E 03	0.0	0.0
0.023	-6.455E 03	0.0	0.0
0.024	-6.455E 03	0.0	0.0
0.025	-6.455E 03	0.0	0.0
0.026	-6.455E 03	0.0	0.0
0.027	-6.422E 03	0.0	0.0
0.028	-6.236E 03	0.0	0.0
0.029	-5.924E 03	0.0	0.0
0.030	-5.524E 03	0.0	0.0
0.031	-5.051E 03	0.0	0.0
0.032	-4.512E 03	0.0	0.0
0.033	-3.952E 03	0.0	0.0
0.034	-3.415E 03	0.0	0.0
0.035	-2.859E 03	0.0	0.0
0.036	-2.270E 03	0.0	0.0
0.037	-1.646E 03	0.0	0.0
0.038	-1.014E 03	0.0	0.0
0.039	-4.118E 02	0.0	0.0
0.040	0.0	0.0	0.0
0.041	0.0	0.0	0.0
0.042	0.0	0.0	0.0
0.043	0.0	0.0	0.0
0.044	0.0	0.0	0.0
0.045	0.0	0.0	0.0
0.046	0.0	0.0	0.0
0.047	0.0	0.0	0.0
0.048	0.0	0.0	0.0
0.049	0.0	0.0	0.0
0.050	0.0	0.0	0.0
0.051	0.0	0.0	0.0
0.052	0.0	0.0	0.0
0.053	0.0	0.0	0.0
0.054	0.0	0.0	0.0



BEAM 55 I,M = 29, 5 J,N = 30, 1 RELATIVE DEFLECTIONS*J-I*(IN)

SCALE FACTOR = 1.242E 00

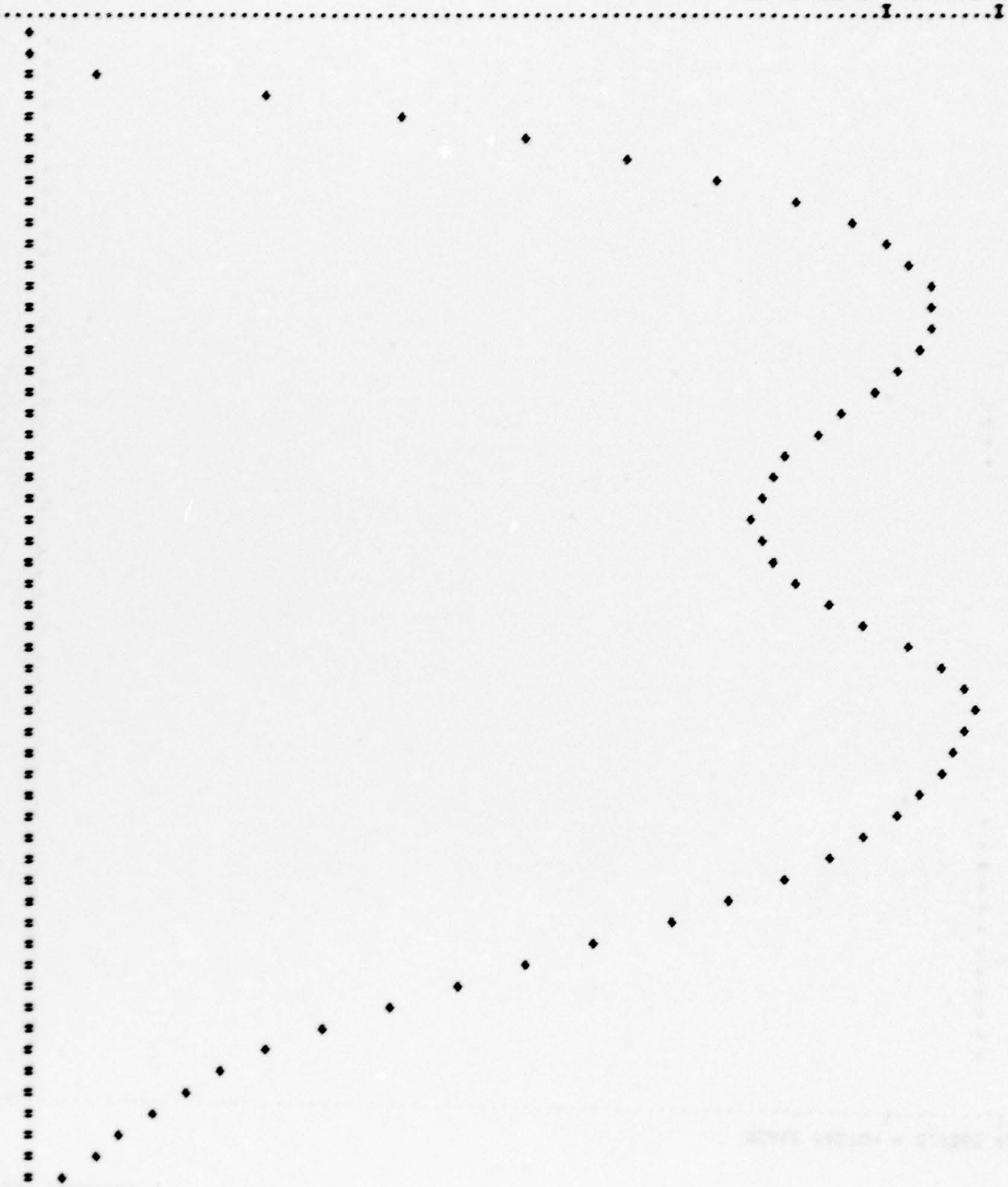
TIME(SEC)	X *	Y =	Z +
0.0	0.0	0.0	0.0
0.001	-3.766E-03	-1.008E-03	1.248E-03
0.002	-4.638E-02	-1.558E-02	1.578E-02
0.003	-1.186E-01	-5.472E-02	4.894E-02
0.004	-2.345E-01	-1.055E-01	1.232E-01
0.005	-3.803E-01	-1.453E-01	2.107E-01
0.006	-5.675E-01	-1.869E-01	2.933E-01
0.007	-7.834E-01	-2.187E-01	3.780E-01
0.008	-1.029E 00	-2.332E-01	4.676E-01
0.009	-1.299E 00	-2.382E-01	5.459E-01
0.010	-1.600E 00	-2.338E-01	6.051E-01
0.011	-1.918E 00	-2.130E-01	6.383E-01
0.012	-2.248E 00	-1.749E-01	6.467E-01
0.013	-2.582E 00	-1.300E-01	6.299E-01
0.014	-2.911E 00	-8.444E-02	5.901E-01
0.015	-3.229E 00	-3.003E-02	5.371E-01
0.016	-3.530E 00	4.026E-02	4.897E-01
0.017	-3.810E 00	1.180E-01	4.657E-01
0.018	-4.068E 00	1.867E-01	4.817E-01
0.019	-4.305E 00	2.389E-01	5.260E-01
0.020	-4.529E 00	2.698E-01	5.740E-01
0.021	-4.734E 00	2.715E-01	6.149E-01
0.022	-4.908E 00	2.400E-01	6.510E-01
0.023	-5.054E 00	1.825E-01	6.927E-01
0.024	-5.165E 00	1.122E-01	7.503E-01
0.025	-5.238E 00	4.421E-02	8.354E-01
0.026	-5.273E 00	-8.890E-03	9.534E-01
0.027	-5.271E 00	-4.249E-02	1.101E 00
0.028	-5.237E 00	-6.781E-02	1.270E 00
0.029	-5.179E 00	-9.072E-02	1.445E 00
0.030	-5.102E 00	-1.106E-01	1.624E 00
0.031	-5.008E 00	-1.174E-01	1.809E 00
0.032	-4.896E 00	-1.045E-01	1.995E 00
0.033	-4.775E 00	-7.596E-02	2.172E 00
0.034	-4.653E 00	-3.383E-02	2.341E 00
0.035	-4.521E 00	2.727E-02	2.501E 00
0.036	-4.375E 00	1.089E-01	2.664E 00
0.037	-4.212E 00	2.063E-01	2.832E 00
0.038	-4.039E 00	3.080E-01	2.999E 00
0.039	-3.865E 00	4.007E-01	3.163E 00
0.040	-3.686E 00	4.773E-01	3.322E 00
0.041	-3.489E 00	5.418E-01	3.474E 00
0.042	-3.286E 00	5.862E-01	3.622E 00
0.043	-3.088E 00	5.953E-01	3.759E 00
0.044	-2.889E 00	5.612E-01	3.892E 00
0.045	-2.676E 00	4.909E-01	4.025E 00
0.046	-2.446E 00	4.036E-01	4.163E 00
0.047	-2.205E 00	3.201E-01	4.302E 00
0.048	-1.962E 00	2.571E-01	4.437E 00
0.049	-1.722E 00	2.126E-01	4.573E 00
0.050	-1.489E 00	1.781E-01	4.707E 00
0.051	-1.241E 00	1.504E-01	4.827E 00
0.052	-9.719E-01	1.312E-01	4.943E 00
0.053	-7.052E-01	1.200E-01	5.055E 00
0.054	-4.534E-01	1.[illegible]01E-01	5.160E 00



EXTERNAL SPRING I,M = 2, 8 COMPRESSION(IN)

SCALE FACTOR = 1.875E-01

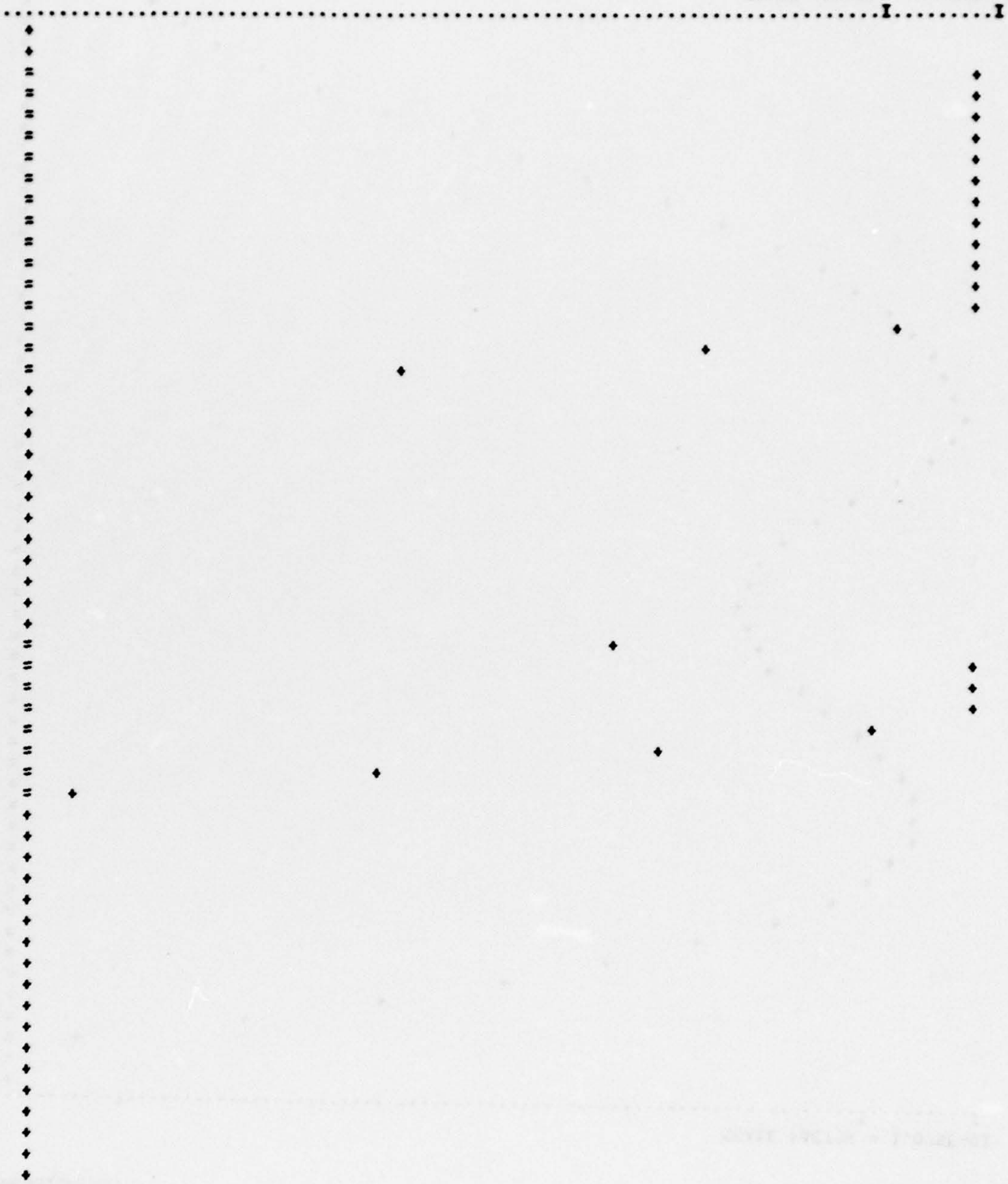
TIME(SEC)	X *	Y =	Z +
0.0	0.0	0.0	0.0
0.001	0.0	0.0	0.0
0.002	0.0	0.0	1.126E-01
0.003	0.0	0.0	3.864E-01
0.004	0.0	0.0	6.269E-01
0.005	0.0	0.0	8.212E-01
0.006	0.0	0.0	9.949E-01
0.007	0.0	0.0	1.142E 00
0.008	0.0	0.0	1.266E 00
0.009	0.0	0.0	1.361E 00
0.010	0.0	0.0	1.426E 00
0.011	0.0	0.0	1.469E 00
0.012	0.0	0.0	1.495E 00
0.013	0.0	0.0	1.506E 00
0.014	0.0	0.0	1.498E 00
0.015	0.0	0.0	1.478E 00
0.016	0.0	0.0	1.445E 00
0.017	0.0	0.0	1.406E 00
0.018	0.0	0.0	1.355E 00
0.019	0.0	0.0	1.305E 00
0.020	0.0	0.0	1.263E 00
0.021	0.0	0.0	1.235E 00
0.022	0.0	0.0	1.212E 00
0.023	0.0	0.0	1.208E 00
0.024	0.0	0.0	1.216E 00
0.025	0.0	0.0	1.230E 00
0.026	0.0	0.0	1.276E 00
0.027	0.0	0.0	1.326E 00
0.028	0.0	0.0	1.390E 00
0.029	0.0	0.0	1.460E 00
0.030	0.0	0.0	1.526E 00
0.031	0.0	0.0	1.565E 00
0.032	0.0	0.0	1.575E 00
0.033	0.0	0.0	1.565E 00
0.034	0.0	0.0	1.542E 00
0.035	0.0	0.0	1.513E 00
0.036	0.0	0.0	1.481E 00
0.037	0.0	0.0	1.440E 00
0.038	0.0	0.0	1.390E 00
0.039	0.0	0.0	1.332E 00
0.040	0.0	0.0	1.262E 00
0.041	0.0	0.0	1.169E 00
0.042	0.0	0.0	1.062E 00
0.043	0.0	0.0	9.445E-01
0.044	0.0	0.0	8.226E-01
0.045	0.0	0.0	7.051E-01
0.046	0.0	0.0	5.950E-01
0.047	0.0	0.0	4.877E-01
0.048	0.0	0.0	3.956E-01
0.049	0.0	0.0	3.177E-01
0.050	0.0	0.0	2.556E-01
0.051	0.0	0.0	1.990E-01
0.052	0.0	0.0	1.495E-01
0.053	0.0	0.0	1.074E-01
0.054	0.0	0.0	6.121E-02



EXTERNAL SPRING I,M = 2, 0 AXIAL LOAD(LB)

SCALE FACTOR = 2.726E 02

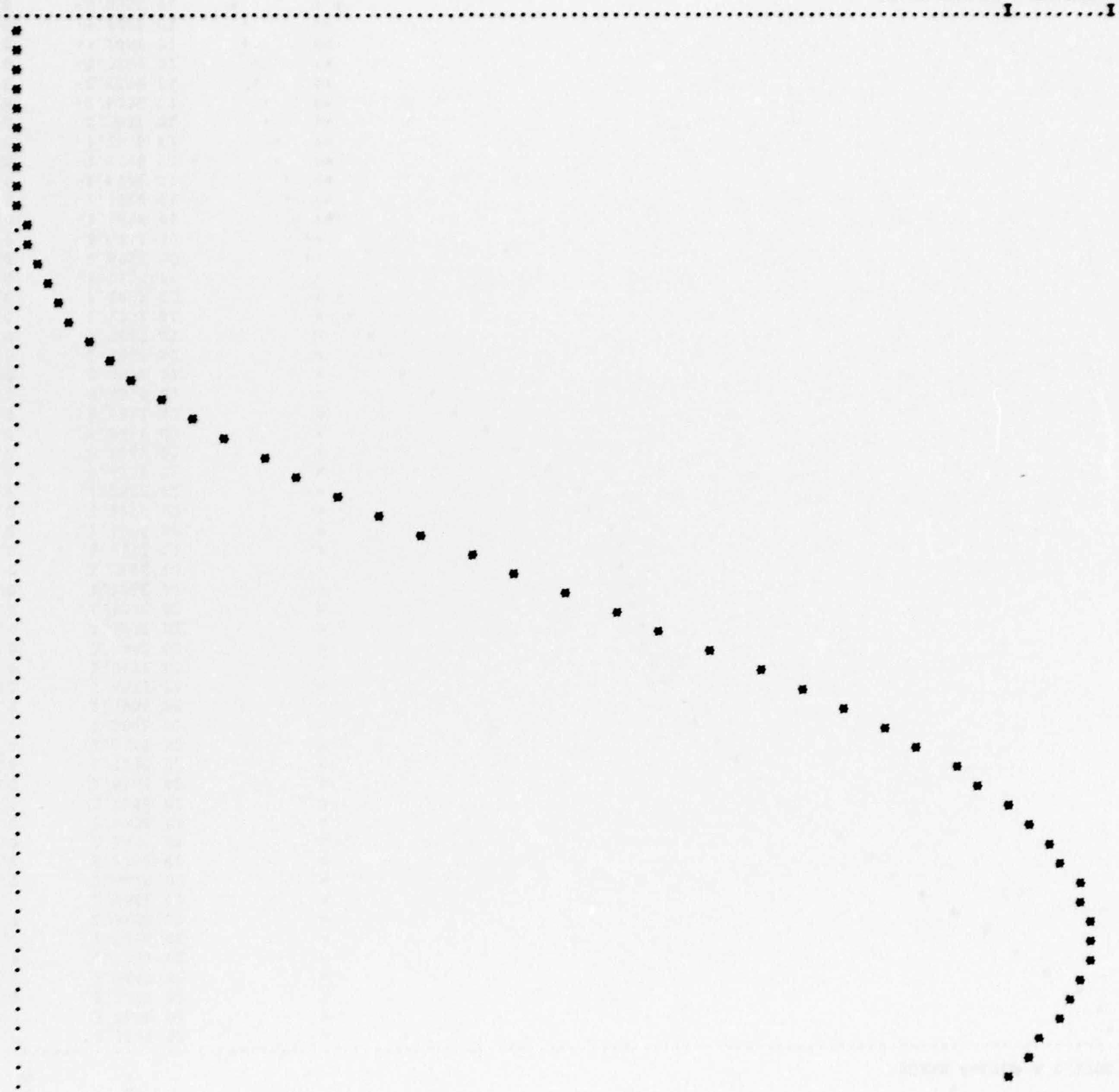
TIME(SEC)	X *	Y =	Z +
0.0	0.0	0.0	0.0
0.001	0.0	0.0	0.0
0.002	0.0	0.0	2.290E 03
0.003	0.0	0.0	2.290E 03
0.004	0.0	0.0	2.290E 03
0.005	0.0	0.0	2.290E 03
0.006	0.0	0.0	2.290E 03
0.007	0.0	0.0	2.290E 03
0.008	0.0	0.0	2.290E 03
0.009	0.0	0.0	2.290E 03
0.010	0.0	0.0	2.290E 03
0.011	0.0	0.0	2.290E 03
0.012	0.0	0.0	2.290E 03
0.013	0.0	0.0	2.290E 03
0.014	0.0	0.0	2.113E 03
0.015	0.0	0.0	1.643E 03
0.016	0.0	0.0	8.964E 02
0.017	0.0	0.0	0.0
0.018	0.0	0.0	0.0
0.019	0.0	0.0	0.0
0.020	0.0	0.0	0.0
0.021	0.0	0.0	0.0
0.022	0.0	0.0	0.0
0.023	0.0	0.0	0.0
0.024	0.0	0.0	0.0
0.025	0.0	0.0	0.0
0.026	0.0	0.0	0.0
0.027	0.0	0.0	0.0
0.028	0.0	0.0	0.0
0.029	0.0	0.0	1.407E 03
0.030	0.0	0.0	2.290E 03
0.031	0.0	0.0	2.290E 03
0.032	0.0	0.0	2.288E 03
0.033	0.0	0.0	2.043E 03
0.034	0.0	0.0	1.521E 03
0.035	0.0	0.0	8.520E 02
0.036	0.0	0.0	1.215E 02
0.037	0.0	0.0	0.0
0.038	0.0	0.0	0.0
0.039	0.0	0.0	0.0
0.040	0.0	0.0	0.0
0.041	0.0	0.0	0.0
0.042	0.0	0.0	0.0
0.043	0.0	0.0	0.0
0.044	0.0	0.0	0.0
0.045	0.0	0.0	0.0
0.046	0.0	0.0	0.0
0.047	0.0	0.0	0.0
0.048	0.0	0.0	0.0
0.049	0.0	0.0	0.0
0.050	0.0	0.0	0.0
0.051	0.0	0.0	0.0
0.052	0.0	0.0	0.0
0.053	0.0	0.0	0.0
0.054	0.0	0.0	0.0



DRI MASS 32

SCALE FACTOR = 2.685E 00

TIME(SEC)	DRI
0.0	0.0
0.001	-4.796E-04
0.002	-8.024E-04
0.003	-2.644E-04
0.004	2.260E-03
0.005	8.342E-03
0.006	1.983E-02
0.007	3.889E-02
0.008	6.906E-02
0.009	1.171E-01
0.010	1.906E-01
0.011	3.006E-01
0.012	4.606E-01
0.013	6.833E-01
0.014	9.808E-01
0.015	1.364E 00
0.016	1.843E 00
0.017	2.422E 00
0.018	3.084E 00
0.019	3.816E 00
0.020	4.609E 00
0.021	5.459E 00
0.022	6.363E 00
0.023	7.322E 00
0.024	8.338E 00
0.025	9.411E 00
0.026	1.054E 01
0.027	1.172E 01
0.028	1.295E 01
0.029	1.421E 01
0.030	1.549E 01
0.031	1.676E 01
0.032	1.801E 01
0.033	1.923E 01
0.034	2.039E 01
0.035	2.148E 01
0.036	2.251E 01
0.037	2.345E 01
0.038	2.431E 01
0.039	2.508E 01
0.040	2.576E 01
0.041	2.634E 01
0.042	2.683E 01
0.043	2.723E 01
0.044	2.755E 01
0.045	2.777E 01
0.046	2.789E 01
0.047	2.793E 01
0.048	2.787E 01
0.049	2.771E 01
0.050	2.747E 01
0.051	2.714E 01
0.052	2.672E 01
0.053	2.622E 01
0.054	2.565E 01



VEHICLE C.G. VELOCITY(IN/SEC)

TIME(SEC)	X *	Y =	Z +
0.0	-6.661E-16	0.0	3.300E 02
0.001	-2.604E-04	0.0	3.269E 02
0.002	-5.571E-04	0.0	3.171E 02
0.003	-6.060E-04	0.0	3.044E 02
0.004	-7.714E-04	0.0	2.916E 02
0.005	-9.774E-04	0.0	2.788E 02
0.006	-1.101E-03	0.0	2.660E 02
0.007	-1.377E-03	0.0	2.532E 02
0.008	-1.841E-03	0.0	2.404E 02
0.009	-2.596E-03	0.0	2.276E 02
0.010	-3.763E-03	0.0	2.149E 02
0.011	-5.640E-03	0.0	2.030E 02
0.012	-8.561E-03	0.0	1.919E 02
0.013	-1.288E-02	0.0	1.816E 02
0.014	-1.901E-02	0.0	1.719E 02
0.015	-2.728E-02	0.0	1.632E 02
0.016	-3.797E-02	0.0	1.556E 02
0.017	-5.121E-02	0.0	1.493E 02
0.018	-6.689E-02	0.0	1.439E 02
0.019	-8.490E-02	0.0	1.391E 02
0.020	-1.053E-01	0.0	1.349E 02
0.021	-1.283E-01	0.0	1.323E 02
0.022	-1.538E-01	0.0	1.304E 02
0.023	-1.820E-01	0.0	1.286E 02
0.024	-2.131E-01	0.0	1.262E 02
0.025	-2.472E-01	0.0	1.231E 02
0.026	-2.838E-01	0.0	1.188E 02
0.027	-3.223E-01	0.0	1.129E 02
0.028	-3.630E-01	0.0	1.052E 02
0.029	-4.061E-01	0.0	9.427E 01
0.030	-4.508E-01	0.0	8.126E 01
0.031	-4.951E-01	0.0	6.846E 01
0.032	-5.359E-01	0.0	5.611E 01
0.033	-5.692E-01	0.0	4.431E 01
0.034	-5.906E-01	0.0	3.384E 01
0.035	-5.950E-01	0.0	2.506E 01
0.036	-5.773E-01	0.0	1.768E 01
0.037	-5.323E-01	0.0	1.137E 01
0.038	-4.552E-01	0.0	5.289E 00
0.039	-3.413E-01	0.0	-1.912E-01
0.040	-1.874E-01	0.0	-4.691E 00
0.041	8.207E-03	0.0	-8.441E 00
0.042	2.443E-01	0.0	-1.161E 01
0.043	5.189E-01	0.0	-1.421E 01
0.044	8.293E-01	0.0	-1.670E 01
0.045	1.172E 00	0.0	-1.914E 01
0.046	1.543E 00	0.0	-2.151E 01
0.047	1.938E 00	0.0	-2.381E 01
0.048	2.352E 00	0.0	-2.603E 01
0.049	2.779E 00	0.0	-2.815E 01
0.050	3.216E 00	0.0	-3.017E 01
0.051	3.656E 00	0.0	-3.208E 01
0.052	4.094E 00	0.0	-3.387E 01
0.053	4.527E 00	0.0	-3.555E 01
0.054	4.949E 00	0.0	-3.711E 01

SCALE FACTOR = 4.370E 01